SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, MAY 12, 1905.

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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION D, MECHANICAL SCIENCE AND ENGINEERING.

THE meetings were held in the engineering building of the University of Pennsylvania. The following officers were elected to serve during the meeting:

Councilor—F. W. McNair, president Michigan College of Mines, Houghton, Mich.

Member of the General Committee—H. S. Jacoby, professor of bridge engineering, Cornell University, Ithaca, N. Y.

Member of the Sectional Committee, 1905 to 1910—A. M. Greene, Jr., professor of mechanical engineering, University of Missouri, Columbia, Mo.

The secretary of the section was elected press secretary; vice-president and chairman of the section D. S. Jacobus, professor of experimental engineering, Stevens Institute, Hoboken, N. J., was forced to be absent, owing to illness in his family. The sectional committee appointed Calvin M. Woodward, ex-vice-president of the section, to act as chairman of the section for the meeting.

The program had been arranged so that papers pertaining to civil engineering, mechanical engineering, metallurgical engineering and general engineering, and to engineering education, should be read at separate sessions. The program of Wednesday morning, December 28, was devoted to civil engineering. The first paper on the program was by C. G. Elliott, expert in irrigation and drainage investigations of the Department of Agriculture, Washington, D. C., and was on 'Irrigation and Drainage Investigations of the Department

of Agriculture.' He showed that while chemical analysis may show that two soils are equally rich in plant food, yet on account of unfavorable water conditions, one of them may be quite unproductive, and the different portions of even the same field may vary in their production on account of differences in the water content of the soil. The supply of water and the control or regulation of its quantity in soils of different classes under varying climatic conditions for the production of crops of a first-class character present an important field which now occupies the attention of the irrigation and drainage investigations. The objects of this work are to ascertain the best methods and provoke their use in applying water to soils where it is deficient, conserving and regulating its quantity, removing surplus from saturated soils and reclaiming and protecting lands from overflow, all of which invokes a variety of engineering practise. The soil water necessary for the growth of plants is held about soil drains in films and is removed from the soil by capillarity, plant absorption and surface evaporation only. Irrigation must supply this amount when deficient, and any surplus must be removed by drainage. The water-holding capacity of different soils is an important subject for investigation. The part of the engineer is to provide means for supplying, regulating and controlling the soil water to meet the needs of the various kinds of soils encountered and plants grown therein, and includes a study of the movements of water, both by capillarity and by gravity.

Henry S. Jacoby, professor of bridge engineering, Cornell University, Ithaca, N. Y., presented 'Some Notes on Reinforced Concrete Arches,' giving the results of his study and investigations during the past year and supplementing his previous papers.

E. J. McCaustland, assistant professor in civil engineering, Cornell University, Ithaca, N. Y., next presented a paper on 'Tests of Reinforced Concrete Beams,' in which he presented the data and conclusions obtained from the tests to failure of twenty-three beams of concrete, reinforced by plain and various forms of patented bars of steel. They were 6 by 8 inches in size and 6 feet long. Plain square steel rods were used, varying in sizes from $\frac{3}{8}$ to $\frac{3}{4}$ inch and placed either $1\frac{1}{4}$ or 2 inches from the lower face of the beam. The beams were made of a very lean concrete (1 cement, 2.5 sand and 9 broken limestone), so that in all cases the steel reinforcing bars developed full strength of the concrete before reaching the elastic limit. Deflections were measured, and also the extensions of the lower fibers. A careful watch was kept to determine the appearance of fine cracks. The loads were released after each reading so as to measure the set. Tests of the beams with plain square bars showed poor adhesion and the early development of fine cracks, so that the smallest percentage of reinforcement seemed sufficient. The beams having reinforcement $1\frac{1}{4}$ inches from the lower face showed greatest strength. In the second series sets of beams were laid up with reinforcements of Ransome bars, Johnson corrugated bars, Kahn bars, corrugated bars with iron stirrups, Thatcher bars, and two beams with plain bars for comparison. The ratio of reinforcement was made about 0.58 per cent. and the center of the steel bars was placed $1\frac{1}{2}$ inches from the lower face of the beams. The extensibility of the reinforced concrete in these tests was one in 1,621, while that of the plain concrete was one in 11,000. The results show the superiority of the corrugated bars under ordinary conditions. They also draw sharp attention to an interior weakness in a reinforcement having diagonal wings rigidly attached. The tests show the folly of at-

tempting to reinforce a concrete which will not of itself develop a fair degree of strength, and they throw very serious doubts upon the wisdom of using certain types of diagonal reinforcements in beams. The paper will probably be published in the *Engineering Record*.

Owing to the absence of Mr. Richard L. Humphrey, consulting engineer, of Philadelphia, his paper on 'Some Notes on the Manufacture and Testing of Cement' was read only by title.

In a paper on 'The Menace to the Entrance of New York Harbor,' by Lewis M. Haupt, consulting engineer, Philadelphia, after reviewing the different projects which have been carried on by the general government for the improvement of the channels leading into the lower bay, the author showed by means of charts that in the past century the inlet to Jamaica Bay has moved seven miles to the west, and also that the spit at Sandy Hook has advanced about a mile, and is now moving into the bay, depositing half a million yards of sand every year. It was held that these encroachments upon the entrance to New York harbor formed a menace which could no longer be overlooked. The author found a remedy in a single reaction training wall which would concentrate the ebb of the currents and prevent the continued deposit of drift which threatens to convert Coney Island and Manhattan Beach into lagoons. The estimated cost of this would be but one-half of the present contract for dredging the channel, which it is stated can not be maintained, as it fills up very rapidly. The paper was subsequently read before Section E; and extracts of it were published in the New York daily papers and caused much discussion in both engineering and commercial circles.

At the conclusion of this paper, Section D joined the meeting of Section I to listen to a paper and discussion on 'Specialization in Manufacturing' by Alexander E. Outerbridge, Jr., metallurgist of William Sellers & Company, Incorporated, of Philadelphia. The paper gave data from actual experience, showing the enormous economies, as well as limitations, of the modern methods of concentrated effort and capital in a single production, as compared with older methods in general practise. The paper will be found in full in the January issue of the *Annals of the American Academy of Political and Social Science*.

On Wednesday afternoon after luncheon the members of the section, in charge of competent guides, visited the new electric power station of the Philadelphia Electric Company. This station presented a notable illustration of the many uses of concrete, of which the most novel was probably the installation of the high tension wires and fuses in vertical cases made of monolithic concrete construction.

Later the members visited the high pressure fire service plant of the city of Philadelphia. This plant is notable in that the large triplex power pumps are operated by gas-engines supplied with artificial gas from the city mains. No standby losses are incurred, full pressure is available in two minutes from the time the fire alarm is sounded, which is much sooner than the company can get to the hydrant nearest to the fire. The quantity of water is much larger than could be obtained by the normal number of fire engines, while ample provision in the way of valves has been made for the bursting of mains.

On Thursday morning, owing to the absence of the author, paper number seven, on 'Some Notes on Ventilating Problems,' by Charles B. Dudley, of the Pennsylvania Railroad Co., Altoona, Pa., was read by title only. It was followed by an interesting paper by C. J. Zintheo, professor of farm mechanics, Iowa State College, Ames,

Ia., on 'American Machinery as a Factor in Agriculture':

"Farm machinery has made it possible to develop the vast agricultural resources of the country. During the first two hundred years after the Pilgrim Fathers settled on the American shore, the resources of the country failed to bring about any increase of importance in commerce or in the products of agriculture. As late as 1845, people did not raise enough wheat for their bread. With the advent of the steel plow, the self-binding harvester and the steam threshing machine, there was a marked change in the producing power of the American people. Our food supply increased from 4.33 bushels of wheat per person in 1845 to 5.50 bushels of wheat in 1859; to 7.45 bushels in 1869, and as high as ten bushels in 1889. During the same time the population on the farms had decreased to 80 per cent. in 1850 and 33 per cent. in 1900. The American farmers of to-day with one third the labor of the country produce enough food to support, not only themselves, but the other 67 per cent. that live in the cities, and exported farm products during the year 1904 to the value of the enormous sum of $960,000,000, according to the United States Secretary's report. This same report states that in 1830 it took over three hours' labor to raise one bushel of wheat; in 1896 it took ten minutes. In 1830 the labor in one bushel of wheat cost 17¾ cents; in 1896 it cost 3½ cents. In 1850 the labor represented in a bushel of corn was four and one half hours, while in 1894 it had been reduced to forty-one minutes. (This has been greatly reduced since then by the introduction of the more modern corn harvesting machines.) In 1860 it is estimated that the labor in one ton of hay in bales represented 35½ hours, while in 1894 this labor was reduced to 11½ hours, or from a cost of $3.00 in labor to $1.29 in labor. The report estimates that in the year 1899 the agricultural implements in the United States saved in human labor the sum of $681,471,827. This country is the greatest maker and user of agricultural implements in the world, and this is largely due to the fact that this country is the most prosperous agricultural country in the world. It has enabled the farmer to pay the high price for labor caused by the competition of our manufacture, and has taken away from farm life much of the drudgery and manual labor and made it in the best sense an intellectual pursuit. Improvements in machinery have brought about a steady decrease in the cost of production, notwithstanding the steady rise in wages. To give an idea of the vast sums of money invested in farm machinery, take, for instance, the following states: Iowa has $57,960,000 invested; New York, $56,006,000; Pennsylvania, $50,917,240; Illinois, $44,977,310; and Ohio, $36,354,450. The total value of implements on farms in this country is $761,261,000, an average of $133 per farm and 90 cents per acre of farm land. The American farmers buy annually $100,000,000 of farm implements. New designs of farm machinery are being constantly added, so that the farm machinery is surely the greatest factor in the development of American Agriculture."

In a paper on 'A Method of Determining the Moisture Existing in Steam at Atmospheric Pressure,' D. S. Jacobus, professor of experimental engineering, Stevens Institute of Technology, Hoboken, N. J., illustrated with blue prints and described the method which he had adopted for determining the dryness of steam. It consisted of mingling a known weight of superheated steam with a known weight of saturated steam at atmospheric pressure. The steam was still superheated after mingling and its temperature was measured. Careful measurements were made to

determine the radiation of the apparatus. From data thus obtained the amount of moisture in the saturated steam was determined. This method is similar to that employed by Mr. George H. Barrus in one of the older forms of his calorimeters. The particular problem to be investigated was how much moisture would be contained in steam at atmospheric pressure after it had passed through two separators of a certain form. The tests showed that the steam at atmospheric pressure leaving the separators contained about one tenth of one per cent. of moisture, a result which was within the probable error of the instrument, for which reason it was fair to conclude that the steam was dry.

The paper will be published in the *Engineering Review*.

G. W. Bissell, professor of mechanical engineering, Iowa State College, Ames, Ia., next presented a paper on 'Hot Blast Heating and Ventilating,' giving results of experiments on the heating and ventilation of the new engineering building of Iowa State College. This building is equipped with Sturtevant hot blast apparatus, the Paul system of vacuum steam heating, and the Powers system of temperature regulation. The total steam condensation was measured hourly, and continuous records were kept for two months. Forty-three separate tests were made at steam pressures, varying from 5 to 25 pounds and with air pressures varying from 0.6 to 1.5 inches. The paper gave a series of tests showing the coefficients of condensation with one or more sections of coils in use, and at different steam pressures, and with different quantities of air being forced over the coils. The paper was published in the *Engineering Review*.

In a case where a man was killed by the bursting of an elbow on a steam main near which he was working, the question arose as to the number of pieces into which such would be broken if it were struck with a hammer when under steam pressure. D. S. Jacobus, professor of experimental engineering, Stevens Institute of Technology, Hoboken, N. J., presented the results of tests which he had made on fittings of the same size and weight as the one which caused the accident and on some similar fittings. The former was an extra heavy elbow for a three-inch standard pipe. The smaller fittings which were tested were of two-inch standard size and of the ordinary weight. In the tests, the elbows were broken by hitting them with a hammer swung by hand when they were subjected to pressures of 80 and 100 pounds per square inch. The hammer, together with its handle, weighed four pounds. The fittings were struck on the outside directly over each of the screw threads at points directly opposite the neck and in the plane passing through the pipe centers. The extra heavy three-inch elbows broke in two nearly symmetrical halves, the plane of breakage being that passing through the pipe centers. The two-inch fittings of ordinary weight broke in two to four or more irregular pieces. The paper was published in the *Engineering Record*.

L. E. Löewenstein, of the Department of Mechanical Engineering, Lehigh University, South Bethlehem, Pa., next presented a paper on 'Some of the Scientific Features and Development of the Steam Turbine.' As the author is the American translator of Professor Stadola's German work on this subject, the paper was of much interest to the audience which heard it.

In a third paper by Professor Jacobus, the angular displacement of the revolving fields of two alternating current electric generators when connected in parallel was determined by actual measurements and compared with the computed amounts. The results were found to agree very closely with each other. The generators on which

the tests were made were of 1,500 kw. capacity and were located at the Manchester Street Station of the Rhode Island Co., Providence, R. I. Large counterweights had been placed on the engines in order to reduce the amount that they shook the building. It was shown theoretically that when the generators were coupled together with the counterweights opposed, or at 180° from each other, the angular displacement was about twice what it would have been without the counterweights. The maximum displacement due to counterweight action and to irregularity in the effort exerted on the crank shaft was found by theory to be 3.2 pole degrees and by observation from 3 to 4 pole degrees. The amount of angular displacement was observed to be the same, irrespective of the position of the counterweights, but when the counterweights were opposed the displacements occurred every stroke, or about 94 times per minute, whereas, when the counterweights were together, or nearly so, the displacements occurred at less frequent intervals, or about 30 to 40 times per minute. As the total displacement of the two fields from their true positions, as observed, was about the same irrespective of the relative positions of the two counterweights, it follows that this displacement was produced as much through governor action as through any variation in the turning effort during a single revolution.

On Thursday afternoon, under the able guidance of Professor Marburg, the members of the section were guests at luncheon of the contractor for the Belmont Filtration Plant. After enjoying the social features of the afternoon, the members of the party were conducted through the gate house, filtering galleries, and had the details of the operation explained to them in much detail by Mr. John W. Hill, chief engineer of the bureau of filtration, and his son. The observations of the afternoon made the succeeding illustrations of the evening much more real and valuable to those who had the privilege of hearing both the afternoon demonstrations and the evening lecture.

The Thursday evening session of Section D was devoted to three extremely valuable papers by notable engineers of the city of Philadelphia, on subjects which are of much interest, both to engineers and citizens of Philadelphia and to engineers and scientists at large. They were very fully illustrated by lantern slides. The first was by J. W. Hill, chief engineer of the Bureau of Filtration of the Department of Public Works of Philadelphia, and was on 'The Philadelphia Filtration System.'

The second paper of the evening was by Wm. S. Twining, chief engineer of the Philadelphia Rapid Transit Co., and described and illustrated 'The Subway and Elevated Railroad of the Philadelphia Rapid Transit Company.'

The third paper was by George H. Webster, chief engineer, bureau of surveys of the board of public works of Philadelphia, and was on 'Modern Engineering in the City of Philadelphia, under the Direction of the Bureau of Surveys.'

These papers were both most entertaining and instructive, and showed the great advances which have been made in the practical applications of engineering science in the municipal affairs of the city of Philadephia in providing for the citizens a healthful water supply, rapid and convenient methods of transportation, and up-to-date and modern methods of keeping records and performing the routine work of the office of city engineer in a large municipality.

The first paper on the program of Friday morning, December 30, was by Arthur H. Blanchard, assistant professor of civil engineering, Brown University, Providence, R. I., and was on 'The Development

of the State Highway System of Rhode Island':

"The first tangible step towards the establishment of a state system of continuous highways in Rhode Island was the passage of an 'act to provide for the construction, improvement and maintenance of state roads' by the General Assembly in 1902. The salient features of the 1902 act are as follows: the construction and maintenance of the state highway system is vested in a board, consisting of five members, who serve without remuneration: the chief engineer is appointed by the board; the entire expense of construction and maintenance of standard roads is borne by the state, resulting in a maximum benefit to the state as a whole and to the urban as well as the rural communities (the fifteen trunk highways comprising the state system of continuous roads have a total mileage of 249 miles, 18.89 of which was contracted for by the state in 1903); an annual appropriation of $5,000 for general office expenses is included in the act: annual construction appropriations are based upon the annual reports of the board ($100,000 in 1903 and $100,000 in 1904); cost of extra width, in excess of fourteen feet, is to be borne by the towns concerned. The standard macadam road consists of 14 feet of 6-inch macadam, built in two courses of broken stone, with dust used as a top dressing only, the surface being in form, the two intersecting planes having a tranverse slope of three fourths of an inch to the foot. By the knowledge obtained from road metal tests made at Washington, together with information gained from observations on how the material actually wears and binds in practice, the board hopes to reach satisfactory conclusions with reference to the rocks that may be used for road building purposes in Rhode Island. The recognition of the injurious effects of narrow tires upon macadam roads resulted in the passage of an act in 1902 to prohibit the use of narrow tires after April, 1905. It is believed that a rigid enforcement of this law will materially reduce the cost of maintenance of the state roads."

The next two papers on the morning's program were on 'Lines of Progress in Aeronautics,' and were intended to supplement the series of papers on this subject which were presented at the St. Louis meeting of the association. Calvin M. Woodward, dean of the School of Engineering and Architecture of Washington University, St. Louis, Mo., described the efforts which had been made and stated some of the reasons why they had not met with greater success at the Louisiana Purchase Exposition during the past year. Being a member of the committee of the World's Fair on the subject of aeronautics, he was able to speak with positive knowledge.

The second paper was by Mr. K. Dientsbach, of New York, who is the American correspondent of *Illustrierte Aeronautische Mitteillungen*. He reviewed the recent progress made in aeronautical science by Maxim, Langley, Zahm and the Wright Brothers.

In the absence of the author, the paper by David Todd, director of Amherst College Observatory, on 'A Twelve-ton Observatory Dome of Thirty-five Feet Diameter,' was read only by title.

Clarence A. Waldo, professor of mathematics at Purdue University, Lafayette, Ind., presented samples of 'A New Engineering Product, and Some of Its Problems.' The product consisted of metallic materials formed into hollow shapes, such as flasks, floats, spheres, bottles and the like. It was much to be regretted that the exact method of manufacture was not described, and the 'problems' which had been met were only stated and their solution not given.

A. J. Wood, professor of experimental

engineering, Pennsylvania State College, State College, Pa., next read a paper giving the results of his experiments on 'Tests of Cold Drawn Steel Elevator Guides.' He stated that many engineers were of the opinion that the cold rolling improved the tensile strength of steel more than did cold drawing. The paper called attention to tests recently made by the author showing the comparative strengths in transverse loading of hot-rolled and planed T-shaped elevator guide-bars supported on 24-inch centers, as compared with cold-drawn bars made from hot-rolled bars. The open hearth steel which was used contained from 0.12 to 0.15 per cent. of carbon. The hot-rolled bars weighed $14\frac{2}{3}$ pounds per foot, and after rolling 14 pounds per foot. The autographic stress-strain diagrams of the bar show that the actual elastic limit was increased from 13,900 pounds with the hot-rolled bars to 35,000 pounds with the cold-drawn bars, and that the yield point was increased from 17,500 to 38,500 by the process of cold-drawing; that the cold-drawn steel not only deflected less under a given load, but that it suffered less permanent set. The paper will be published by the *American Machinist*.

The last paper of the morning was by C. M. Woodward and was on 'The Track Pressure Resulting from an Eccentric Weight.' The paper elicited considerable discussion from the mathematical engineers who were present. It will be published by the St. Louis Academy of Science.

The session of Friday afternoon was devoted to engineering education. The vice-presidential address of the retiring vice-president, Calvin M. Woodward, dean of the School of Engineering and Architecture, Washington University, St. Louis, Mo., on 'Recent Progress in Engineering Education,' was true to its subject, and as it has been presented in the pages of SCIENCE for January 6, 1905, nothing further need be said.

Edgar Marburg, professor of civil engineering, University of Pennsylvania, next described the new engineering building of the University of Pennsylvania. It is expected that it will cost $700,000, and with its new additional equipment will cost $800,000. It will be capable of providing for 500 engineering students in civil, mechanical and electrical engineering. One of the noteworthy features is that of a large number of small rooms each containing comfortably not over fifteen students. These are to be used for recitation rooms and quizzes. Larger assembly rooms for all the sections of the class are also provided, where one of the instructors can lecture to the class as a whole. This system of instruction and also the details of the building were discussed at considerable length by the educators present.

'Desired Requirements for Entrance to Engineering Colleges' was the subject of a paper by William Kent, dean of the College of Applied Science, Syracuse University, Syracuse, N. Y. He stated that the present requirements included English, history, mathematics, physics, science and modern languages, each of which cultivates a separate group of intellectual faculties. At Syracuse University a change has been made in the direction of broadening the entrance requirements so as to require six groups of study, and including free-hand drawing as one of the essential subjects. It is now proposed to make another change so as to require studies in seven groups, which, besides free-hand drawing, physics or chemistry, shall include one or more natural sciences. The following advantages are claimed for the proposed entrance requirements. First, the requirement of seven studies instead of eight makes it easier for high schools to give a thorough preparation. Second, it will decrease the

number of conditions of entering students. Third, seven subjects selected from the seven groups, each studied with proper thoroughness, give a more liberal and broader education than eight subjects from five groups, including electives which may be selected from the same five groups. Fourth, they include drawing and natural science, without which no one can rightly be said to have a broad and liberal culture. Fifth, by making options in language and in physics and natural science, the requirements favor those high schools which are equipped to give some optional subjects better than others. Requiring either physics or chemistry, and not both, is a convenience to the college, so that either physics or chemistry can be given in the freshman year to those students who do not present one or the other.

The last paper scheduled for the afternoon had been read at a previous session of the section and was on 'The Value of Courses in Agricultural Engineering,' by Elwood Mead, chief of irrigation and drainage investigations, U. S. Department of Agriculture, Washington, D. C.:

"Agricultural engineers have hitherto had little opportunity for practising their profession in the United States, the large areas of cheap land and crude and wasteful methods of cultivation preventing any large expenditures on engineering works for the improvement or reclamation of agricultural areas.

"These conditions are now rapidly changing. The building of canals and dams to irrigate the arid lands of the west, the construction of dikes and drains, and the installation of pumps to remove the surplus water from our swamp and overflowed lands are two of a number of lines of work which are opening up broad fields of usefulness and power to specially trained young men. Our agricultural colleges are recognizing this and beginning to provide adequate courses of instruction. Within the past year the Iowa State College has completed a commodious building, with a complete equipment for instruction in this branch of engineering. Wisconsin is erecting a building; Illinois, Minnesota, Nebraska and Wyoming have courses in agricultural engineering; while Colorado and California make irrigation engineering one feature of their courses in civil engineering. Special training in the administration of canals and in the laws and customs governing the use of streams is required by the irrigation engineer. This is being provided by the agricultural colleges and by the reports of the irrigation and drainage investigations of the Office of Experiment Stations, U. S. Department of Agriculture.

"Drainage engineering is becoming an important factor in agricultural production. The reclamation of the swamp and overflowed lands along our sea and gulf coasts will add nearly 100,000,000 acres to the productive area. Tile underdrains are being made use of to protect hillside farms from erosion.

"Modern farm machinery includes motors run by steam, gasoline, electricity and wind. Where farmers do not understand their care and management, there is great waste and loss. Although this country is the greatest maker and user of farm machinery in the world, the agricultural schools of the United States are far behind those of Europe in the training given on this subject."

The last session of the section was held on Friday evening, and, like those which had preceded it, was provided with a very full program. The first paper of the evening was by John Birkinbine, consulting engineer, of Philadelphia, and discussed 'The Iron Ore Supply of the United States and Its Movement.' The author stated that the advances made in iron manufacture

have been largely brought about by methods of transporting and handling 35,000,000 long tons of iron ore which form the product of the mines of the United States. So successfully has this transportation problem been solved to cheaply handle ores from the mines to cars and from cars through docks to vessels, again from vessels to stock piles or to cars, that a number of deposits of iron ore are lying dormant close to blast furnaces because cheap transportation delivered iron ore of superior quality to the furnaces at a lower cost than it is believed the local ores can be won and used. The excellent quality of the Lake Superior ores and their very low phosphorus and sulphur contents make these ores especially desirable. The ore from the Lake Superior region forms over three fourths of all the iron ore mined in the United States. A large portion of it is not touched by the hand of man from the time it leaves its bed in mother earth until it is charged into the throat of the blast furnace. Steam shovels, automatic chutes, drop bottom cars, mechanical handlers, bridge tramways, bins and skip cars take the place of manual labor and permit handling and transporting large quantities of iron ore at a marvelously low rate. By this means the American iron ores can be conveyed long distances from the mines to the point of consumption at an extremely low rate per ton.

The paper will be found on page 56 of the *Iron Trade Review*, March 16, 1905.

'Science in the Foundry' was the subject of a paper presented by Alexander E. Outerbridge, Jr., metallurgist of Wm. Sellers & Co., Incorporated, of Philadelphia, Pa. It was illustrated with lantern slides showing the interiors of foundries in several large industrial establishments, giving realistic views of immense molds and of castings made therein; of the modern 'overhead traveling cranes,' capable of raising fifty tons or more, and transporting these heavy castings and materials with safety and despatch over the heads of the molders and other workmen on the floor. Pictures showing the characteristic appearance of fractured bars of iron, and of castings of different kinds, ranging from tiny castings weighing a few ounces up to immense machinery castings weighing many tons, were thrown on the screen. Photographs of bars of cast iron which had been caused to 'grow' in cubical dimensions in a remarkable manner, while in the solid state; also photographs of a number of castings which had been increased in size by a novel treatment were shown—for which discovery the Franklin Institute recently awarded to the author the 'Elliot Cresson Gold Medal,' the highest in its power to bestow. Two bars of iron cast in one mold, and of precisely the same size, were presented for critical inspection, one bar remained exactly as cast, the companion bar had been caused to grow gradually in cubical dimensions until it is now 46 per cent. larger than the other, the weight remaining the same as before expansion. Both bars were 'machined' on one side to show the texture and metallic appearance; it was difficult to detect any change except the very apparent difference in size. This extraordinary change in bulk was produced by alternately heating and cooling the bar to a 'critical' temperature a number of times, in the manner which has been fully described in the 'Report of the Committee of Science and Arts of the Franklin Institute.' Important practical applications have already been found for this remarkable discovery. The speaker said that formerly there was no scientific method of supervision in foundry practise, and a chemist in a foundry would have been thought to be as much out of his proper sphere as the proverbial 'bull in a china shop'! That day has gone by, and the substitution of scientific system

for empirical methods in progressive foundries has gradually grown from very small beginnings until it has now reached a recognized position of importance. This is true not only in regard to the metallurgical study of pig iron for castings, but also in methods of molding and other cognate branches of the founder's art. The recent great improvement in the design and construction of molding-machines has led to the gradual substitution of machine molding for hand labor in a large and rapidly expanding degree. The scientific examination of molding sand and other materials used in molding has led to important improvements and economies. In fact, the influence of this newly awakened scientific interest in foundry improvement is extending in all directions. The result is that the manufacturer of machinery is enabled to obtain castings from foundries conducted on modern methods which are far better adapted to the work for which they are designed than heretofore, and he is, therefore, enabled to guarantee quality and strength with an assurance which he could not formerly give. From these observations it may be inferred that, although the field for cast iron has been invaded to a great extent by cast steel, the producers of iron castings have been spurred on to improve their product, and thus to keep in line with the progress of the age, and to show that in spite of this competition the field is still open for their occupation.

One of the most interesting papers of the Philadelphia meeting was on 'Recent Advances in the Mechanical Science Involved in the Coinage of Money,' by Edwin S. Church, superintendent of machinery, United States Mint, Philadelphia. It was illustrated by lantern slides and described in much detail the process of manufacturing money from the power plant with its large engines, through the various processes required in the coinage of money by rolling, stamping, punching and milling, and the great pressures which are necessary to effect the results. Mr. Church made the interesting statement that it was impossible for the new United States Mint at Philadelphia, with all its increased facilities, to supply the demand for copper cents during the two or three weeks immediately preceding the Christmas holidays, showing to what a large extent Christmas is the children's festival, and how largely it enters into the business of our country.

The sectional committee of Section D desires to express its cordial appreciation of the kindly attention and services rendered it by Professor Edgar Marburg and Professor H. W. Spangler, of the University of Pennsylvania, and to the engineers of Philadelphia who so kindly took part, either on the program or in the excursions, or permitted us to visit their works.

It is to be regretted that a larger number of the members of the association were not in attendance, and especially when it is remembered that there has been a large increase in the membership of both the association and the section within the past few years. Papers alone, even by eminent men, do not make a successful meeting. They may form an attractive program, but one of their chief objects is to elicit discussion, without which any program, no matter how good, is likely to fall flat. While there was some discussion over some of the papers presented at the Philadelphia meeting before Section D, neither the attendance of members nor the discussions were as plentiful as was desired. The sectional committee may procure and present a suitable program, but unless the members attend the sessions and take part in the discussions, its work will be largely in vain. It is to be hoped that the members of the association will make a special effort, even if it includes some sacrifice, to attend the meeting at New Orleans next December.

WM. T. MAGRUDER,
Secretary.

THE FISHERIES LABORATORY AT BEAUFORT, SIXTH SEASON.

The Fisheries Laboratory at Beaufort, N. C., was open to investigators for its sixth season from June 10 to September 30, 1904. A few days prior to this time two of the laboratory tables were occupied and a few investigators continued their work after the date of closing, but in these cases the facilities of the laboratory only were supplied, the dining hall, living rooms and electric-light department not being open outside the regular season.

A furnished living room was assigned to each investigator or assistant who desired to live at the laboratory, for the use of which a fee of twenty-five cents was charged to cover the expense of laboratory laundry. Table board was provided at the cost of the materials used and the wages of the waiters, the laboratory, as hitherto, supplying the cook, an assistant, and the kitchen and dining room equipment. The price of board was fixed at $5.50 per week, but, as indicated above, this department was run as a mess and at the end of the season a rebate was paid to each member, which reduced the actual cost of board to about $4.80 per week.

The entire laboratory was lighted with electricity from dusk until eleven o'clock P.M. and the work tables and aquaria in the laboratory and aquarium hall were furnished with a continuous supply of running water, both salt and fresh. The occupant of each table was supplied with a limited amount of glassware and the reagents in common use. The equipment for collecting and general field work, which was available to all, consisted of a steam launch, a 33-foot sharpy, nine rowboats, a pound net, a fyke net, seines, scrape nets, tow nets, dredges, a trawl and implements for digging. With this equipment the entire harbor and the adjacent sounds were within easy reach and, during calm weather, trips were made outside the inlet, where dredgings and towings were frequently made. This equipment was in the charge of Mr. Charles Hatsel, one of the permanent employees of the laboratory. He is an excellent collector and is thoroughly familiar with the animals of the region and the methods by which they may best be collected. Those carrying on scientific work consulted with him concerning the material needed and he either directed how, when and where the collecting should be done or, if necessary, collected and brought the material to the tables.

The staff consisted of a director, custodian, two laborers, five special assistants, thirteen temporary assistants, an engineer and two firemen in the power house, a crew of three on the steam launch *Petrel*, a janitor for the laboratory and living rooms and a cook and an assistant in the kitchen. In addition to these, eight investigators, representing various institutions, occupied tables in the laboratory and carried on work in various fields of inquiry. The average length of the stay of each was seven weeks.

The temporary assistants were assigned for duty as follows: two were detailed to assist Professors H. V. Wilson and George Lefevre with their work; two were given work in the office; four had the care of the laboratory and premises; three, assisted by one of the special assistants, did the seining and fishing with the pound and fyke nets for the laboratory and helped with the work on the fishes when they were brought to the laboratory; one assistant kept a record of the densities, temperatures and the general climatic conditions as observed by him during the season. Several of these men, when not busy with their regular duties, helped with cataloguing the books of the library.

The additions which were made to the equipment of the laboratory during the summer consisted in a pound net, a fyke

net and sixteen rectangular glass aquaria of graded sizes. Two large concrete aquaria also were constructed and fitted with heating apparatus to be used for observations on the effect temperature may have on the structure and development of a species.

Early in the season letters were sent to more than a hundred American zoologists asking them to send their publications, past and future, to the library. In response to these letters several hundred reprints of scientific papers were received, which, added to the publications of the Bureau of Fisheries and the National Museum already on hand, make a valuable part of the equipment.

ECONOMIC AND SCIENTIFIC WORK CARRIED ON BY THE LABORATORY.

The several lines of fishery experiment work which have been in operation in connection with the laboratory for several years were continued and enlarged during this season.* Several weeks during the summer were spent by Mr. R. E. Coker (custodian of the laboratory) in Pamlico Sound in connection with the experiments in oyster culture. The progress of this work is best seen from the report by Caswell Grave, now in press, and from the paper by Mr. R. E. Coker on 'Private Oyster-planting in North Carolina,' also in press. Many new experimental oyster beds were made and will be the subject of further observation.

The growing importance of the clam (*Venus mercenaria*) with the development of the canning and bedding industries, has suggested an inquiry into the habits, growth and propagation of this form. Accordingly, during the preceding spring experiments were begun under the direction of Mr. Coker and these were continued in operation and extended. Arrangements have been made for their continuance during the remainder of the fiscal year.

Mr. Coker continued his study of diversity in the scutes of chelonia, obtaining some material for the further study of correlation in the scutes and bony plates. The forms studied were chiefly the diamond-back terrapin (*Malaclemmys centrata* Latr. and *Thallasoechelys casetta*), but observations were made on a few other species.

The work which is more definitely identified with the summer sessions of the laboratory consists in extended observations on the natural history of the various species representing certain groups of animals and plants. Notes on the following points concerning each species are collected and catalogued: Relative numbers, habitat, food, feeding habits, breeding time, breeding habits, character of eggs, young, migrations, local varieties, etc. Specimens of each species are collected and preserved and placed in the laboratory collection. As a final result of this work it is intended that reports on each group shall be prepared for publication, with descriptions of each species, and illustrations embodying the local observations which have been made. The special assistants who carry on this work are teachers of biology or graduate students in various institutions who have either specialized in or are especially interested at present in the groups in hand. The groups which were studied this season were the sponges, marine algæ, crustacea, actinozoa, fishes and echinoderms.

The work on the Beaufort sponges was begun this season by H. V. Wilson, professor of biology in the University of North Carolina. In addition to a study of the structural characters and natural history of each species he began a series of experiments on the effect of altered temperature and density on the habits of growth, struc-

* The North Carolina Geological Survey cooperates with the Bureau of Fisheries in these investigations.

ture and reproduction of certain forms. Special facilities were afforded for this work and an assistant was detailed to help with it. The observations will probably extend over a number of years. Professor Wilson will report progress from time to time.

Mr. W. D. Hoyt, instructor in biology in the University of Georgia, continued the work on the marine algæ begun by him last season. The intermediate position of Beaufort Harbor between the northern and southern regions, where extended observations have been made on the marine algæ, makes the study of the forms occurring in the Beaufort region especially interesting and important. That it is richer in algæ than has been supposed has been shown by the work already done. During the season twenty-five species were added to the list, which now numbers sixty-nine. All the species are represented by specimens in the laboratory collection. Of the forty species which are properly identified, two are Schizophyceæ, four are Chlorophyceæ, five are Phæophyceæ, four belong to the Dictyotales and twenty-five are Rhodophyceæ. In the case of seventeen forms, the genus only has been determined and in twelve neither the genus nor species is known.

Mr. F. S. Collins, Malden, Mass., has very kindly given valuable suggestions in this work and assisted with the identification of many forms.

Mr. Hoyt has preserved material for morphological work on certain forms and conducted experiments on the branching of *Dictyota dichotoma* induced by injury.

Mr. C. A. Shore, instructor in biology in the University of North Carolina, did for the Beaufort crustacea (exclusive of the amphipods and cirrepedes) this season what the year before he had done for the Annelids—the collection in the laboratory was gone over and, as far as was possible with the available literature on the subject, the specimens were identified. Poor specimens were replaced with perfect ones and specimens of unrepresented species were added when the opportunity afforded. According to the report made by Mr. Shore at the end of the season, the collection now contains specimens of ninety-one species of crustacea, seventy-seven of which are identified. The identification of four is doubtful. In the case of eight forms the genus only has been determined and two are entirely unidentified.

In the above number are included thirteen species collected in 1902 by the *Fish Hawk* from the region between Shackleford and Bogue Banks and the Gulf Stream.

Twenty-two species were added to the list this season and from the unclassified specimens already in the collection thirty-nine species were identified.

Mr. L. R. Cary, graduate student of zoology in the Johns Hopkins University, began work on the anthozoa. In connection with the regular natural history observations and collections, he recorded on charts, provided by the laboratory for the purpose, the local distribution and abundance of each species. His report for the season shows the collection to now contain specimens of eight species of *Alcyonaria*, nine *Actinaria* and three *Madreporaria*. This number does not include the species collected in 1902 by the *Fish Hawk* (two corals excepted), the work on this collection not having been completed. Mr. Cary also made observations on the budding of *Cylista leucolena* and will continue his study this winter on the structure and histology of this form and of the individuals developing from buds.

The actinian larva which has been found from time to time in the tow at Beaufort and which Mr. Cary succeeded in rearing last season and which he described in No. 1, Vol. VII., of the *Biological Bulletin*, has been identified as that of *Epizoanthus*

americana, a species occurring in considerable abundance off the Beaufort Inlet.

Mr. E. W. Gudger, graduate student of zoology in the Johns Hopkins University, had charge of the work on fishes. In addition to the usual work of collecting systematically from various localities, Mr. Gudger undertook the work of determining to what extent the food of two of the most common food fishes, the spot (*Liostomus xanthurus*) and hogfish (*Orthopristis chrysopterus*) differs in different localities and whether local races are being established within each species. This work was not carried far enough to give data of value.

The list of fishes known to occur in the Beaufort region now numbers 134 species. Specimens of each species, with one exception, are preserved in the laboratory collection. In case the adult individuals of a species are very large, specimens of its young only are preserved supplemented with measurements of the adult. Thirteen species were added to the list this year, six of which it has not been possible to identify.

On account of the interruption to the work of investigation caused by visitors the laboratory room has recently been closed to them, but they are welcomed to all other rooms and buildings. In the museum hall the laboratory collections are arranged for inspection and several aquaria are kept supplied with living fishes and other forms of marine animals and plants. The maintenance and care of these exhibits was in charge of Mr. Gudger and the temporary assistant detailed to help with the work on fishes.

Mr. Gudger also continued to study the breeding habits and the early development of the pipe fish (*Siphostoma Louisianæ*). Material was preserved for a detailed study of the egg and young stages this winter.

Caswell Grave, associate in zoology in the Johns Hopkins University, continued to work on the echinoderms. A set of photographs of living specimens of each species is nearly complete. It is hoped that these may be published with the report on the natural history of the Beaufort echinoderms. By isolating the echinoderm larvæ taken in the 'tow' and rearing them through their metamorphosis into the adult form, the identity of several unknown larvæ has been ascertained and many interesting facts regarding the habits of the adults have been discovered. About ninety experiments on the segmenting egg and larva of *Ophiura brevispina* were made in order to study the regenerating capacity of this form in its early stages and to determine the influence which the considerable amount of yolk present in the egg has had on the localization of the germ layers and organ forming materials. The egg and larva of this species are favorable objects for this work in that they live well after injury and in that the eggs fertilized in the laboratory can be reared to the adult form. Experiments on the pluteus of *Mellita testudinata* showed that it lacks almost wholly the ability to regenerate lost parts.

THE INVESTIGATORS AND THEIR WORK.

Dr. George Lefevre, professor of zoology in the University of Missouri, occupied a table in the laboratory from June 15 to August 23. The brief account, given below, of the work done by him is extracted from his report to the director at the end of the season:

1. Artificial parthenogenesis was investigated in *Thalassema mellita* Conn. and it was found that the eggs of this worm could be induced to develop into freely swimming trochophores in the absence of sperm by immersion for a few minutes in very dilute solutions of several acids, both organic and inorganic. Nitric, hydrochloric, sulphuric,

carbonic, acetic and oxalic acids were used successfully, and in favorable experiments fifty to sixty per cent. of the eggs developed into swimming larvæ.

The larvæ arising parthenogenetically are strikingly normal in appearance and structure, and exhibit clearly marked cellular differentiations, as, for example, digestive tract, prototrochal band and apical plate with flagella.

A careful cytological and histological study of the material will be made, and the parthenogenetic development compared in detail with the normal.

2. Material was collected, photographs taken, and observations made in a systematic study of the tunicates of the vicinity of Beaufort.

Dr. Otto C. Glaser, Bruce fellow in the Johns Hopkins University, spent the entire season at the laboratory and engaged in experimental studies on the eggs of *Fasciolaria tulipa,* the natural history of nudibranch molluscs and a study of the development of *Aplysia* sp.?

Aplysias were extremely abundant this season, having been blown upon the Macon Beach and into the harbor by storms. They were actively breeding, and material for the study of the complete life history of the species was secured. Usually this animal is quite rare at Beaufort.

Dr. Glaser also had the supervision of the 'mess' and to his careful management is due the reduction in the price of board which it was possible to make this year.

Mr. Samuel Rittenhouse, graduate student of zoology in the Johns Hopkins University, beginning June 12, spent eight weeks at the laboratory, continuing the studies begun last season on the life history of *Turritopsis nutricula.* From the complete set of material procured he will be able to make a detailed study of the development of this form. He obtained material also for studies of the development of *Stomotoca apicata, S. rugosa* and an undetermined species of *Digonidia.* While gathering this material, by regular towings in various parts of the harbor, Mr. Rittenhouse made observations on the medusæ which appear at Beaufort and preserved specimens of each species. During this season and last he has collected about thirty species of hydromedusæ, seventeen of which are identified.

Mr. Howard E. Enders, professor of zoology in Lebanon Valley College and graduate student in the Johns Hopkins University, was at the laboratory twice during the year, from June 18 to August 6, and during the month of October. He continued his work to get the post-larval stages in the development of the tubicolous annelid, *Chætopterus pergamentaceus,* and collected material for an anatomical and histological study of the adult. Observations were made on the activities of the worm and its numerous commensals within the tube, and on the processes by which the tube is formed. The distribution of the animal in the harbor was charted.

Mr. Bartgis McGlone, professor of biology in the Illinois Wesleyan University, occupied a table in the laboratory for two months beginning June 26. He studied the breeding habits of *Mœra atropos,* the spatangoid so common at Beaufort, and discovered a method by which the eggs may be artificially fertilized. This result has been repeatedly worked for by several investigators without success, and the discovery by Mr. McGlone is a noteworthy contribution from the laboratory, for it opens to experimentation one of the most favorable objects for experimental study; the egg being small and very transparent and one in which the processes of maturation are postponed until extrusion from the body of the mother.

Mr. McGlone preserved material for a

study of the complete life history of the species.

Mr. B. A. Bean, curator of fishes in the National Museum, and his assistant, Mr. McKnew, spent two weeks at the laboratory, June 6–20, studying fishes and making a collection of certain forms for the National Museum. Mr. Bean went over the Beaufort collection of fishes and very kindly verified or corrected the doubtful identifications of some of the specimens. Tanks of alcohol were left by him at the laboratory, with a request that specimens of fishes taken this season, in duplicate, not collected by him, be preserved for the National Museum. This request was complied with.

Dr. J. I. Hamaker, professor of biology in the Randolph-Macon Woman's College, beginning August 18, spent two weeks in general collecting and in making observations on actinians.

CASWELL GRAVE.

SCIENTIFIC BOOKS.

Heredity of Coat Characters in Guinea Pigs and Rabbits. By Professor W. E. CASTLE. Carnegie Institution of Washington, Publication, No. 23. February, 1905.

This paper includes a careful account of the color varieties of domesticated cavies or guinea-pigs, of which the agouti, the yellow, the chocolate, the black, the albino, the spotted, the brindled, the roan and silvered, the long-haired and the rough-coated forms are described. Cross-breeding between many of these types was carried out and a detailed account of the results is given. Without attempting to review all of the many important results of this elaborate study of heredity a few of the more unusual or salient points may be indicated.

Albino or white guinea-pigs breed true, but crossing experiments with pigs of different colors show that individual albinos give different results, which is due, Castle believes, to the presence, in a greater or less degree, of *latent* pigment tendencies, which do not show up except in crossing. Thus the albino ♂ 2002 when mated with red females invariably produces offspring marked with black; while albino ♂ 1999 similarly mated produces only red (or yellow) offspring, never black ones. From these and similar results Castle makes a distinction between the two terms *latency* and *recessive*. Latency "is a condition of inactivity in which a normally *dominant* character may exist in a *recessive* individual. It is questionable whether a recessive character may ever be latent." Recessive is used in Mendel's sense to designate a character "which disappears when brought by fertilization into the same (hybrid) individual with a contrasted 'dominant' character, but which is transmitted, distinct from the dominant character, in half of the gametes formed by the hybrid individual."

As is well known pure albino animals have pink eyes. This means that pigment is absent from the eyes as well as from the skin. Now pure white guinea-pigs and mice are known having black eyes. These are not albinos but 'spotted' animals, in which the pigment spots have been so far reduced as to be practically obliterated, except in the eyes. The black-eyed white animals that appeared in Castle's experiments did not breed true, since spotted offspring often cropped up. Whether by prolonged selection they could be made into a pure race can not be stated, but Castle thinks it not impossible. When mated to pure albinos spotted offspring are produced.

Guinea-pigs with a rough coat are animals whose hair is arranged in rosettes or 'cowlicks' around certain centers. Nine such centers can be recognized in individuals with the best developed rough coats. In crossing these roughs with ordinary or smooth-haired forms the rough character is dominant. Here we have another interesting instance of a recently acquired character dominating in the offspring. The rough character is as fully developed as in the rough parent. The offspring of these rough hybrids follow the Mendelian ratio, provided the *degree* in which the rough character is developed in the offspring is left out of consideration. Just here, however, comes a curious result, that is of the

utmost importance in the debated question of discontinuous *versus* blended inheritance. Although, as has just been said, the rough coat dominates in the first generation of hybrids (rough × smooth), yet sometimes it shows a weakened condition; and what is even more interesting is that certain smooth individuals which may be said to be prepotent show a stronger tendency to weaken the rough coat than do other individuals. Such partially rough individuals may later transmit the rough character to their offspring in its full intensity. Again, repeated crossing of rough animals with prepotent smooth ones leads to a further weakening of the rough coat until it may be almost eliminated. Here are some nuts to crack for those who believe the Mendelian purity of the germ cells depends on the elimination of maternal or paternal chromosomes *which have never mixed* during their sojourn in the same nucleus!

Another apparent Mendelian inconsistency is found in the ratio of inheritance of the long coat, which is dominated by the short, or ordinary coat. In the second generation of inbred hybrids the proportion of long coated individuals exceeds the expected number.

An interesting point in regard to heredity in rabbits is shown when pure white and Himalayan rabbits are crossed. The Himalayan character dominates in the first generation only *imperfectly*, yet complete segregation of the characters takes place in the germ-cells, so that the two pure parent types reappear in some of the offspring.

For other important facts the paper itself must be consulted. That some of the conclusions are only tentative the author himself fully realizes. The constant attention and great labor involved in an extended experiment of this sort will be appreciated by those who have had experience in such matters, and we can confidently expect the future to bring forth many important results from these pedigree animals. Already enough 'problems' are indicated to engage many other workers who have the opportunity, the patience and the skill to give to investigation of this sort. Carefully recorded histories, such as is given for these hybrids, are invaluable to science. Professor Castle is to be much congratulated upon his admirable work.

T. H. Morgan.

Columbia University.

The Stone Reefs of Brazil, their Geological and Geographical Relations, with a Chapter on the Coral Reefs. By John Casper Branner. Bulletin of the Museum of Comparative Zoology, Vol. XLIV. (Geological series, Vol. VII.). Cambridge, Mass. May, 1904.

This important memoir treats of a geological phenomenon that has not hitherto received the attention that its importance and interest, both commercial and scientific, deserve. A port formed by a stone reef harbored in 1500 the fleet of the first Portuguese discoverers of Brazil and the impression produced by it on their minds is strikingly shown by the fact that they applied to it a descriptive title, 'Porto Seguro,' instead of a name taken from the Saint's Calendar, as was the almost universal custom of the early Iberian explorers. From this point as a center a considerable section of the Brazilian coast region was explored and peopled, while two other stone-reef-protected ports, Recife (Pernambuco) and Rio Grande do Norte, became equally or even more important in the history of the early development of the country. The first of these has retained its commercial importance to the present day, and, being situated on a great line of travel, has attracted the attention and excited the wonder of all mariners and travelers who have visited the Brazilian coast. The former very naturally confounded the reefs formed by sandstone with those, still more frequent along this coast, composed of coral rock, and the latter have repeated the sailors' statements to the effect that a large section of the coast is bordered by a reef of the same nature as that of Pernambuco.

The first to accurately describe the Pernambuco reef as a consolidated bar of sand was Darwin, who touched there in the celebrated voyage of the *Beagle*. Hartt, in 1870, showed that the reputed great barrier reef of Brazil was a myth, though detached reefs, both of coral and of sandstone rock, occurred at numerous points; the latter being due to a superficial consolidation of beach sands which

is substantially limited by the planes of high and low tide. The examples of these curious structures hitherto described were in the immediate vicinity of Pernambuco and along the section of coast to the southward of Bahia. The present memoir besides beautifully illustrating those already known with nearly 100 maps and photographs, gives full details of a large number of others between the points above mentioned and to the northward of Pernambuco as far as Rio Grande do Norte. The most southerly one known is at Guarapary in the state of Espirito Santo and from this point to Rio Grande do Norte, a distance of about a thousand nautical miles, the sandstone reefs can now be considered as definitely known. To the southward it is tolerably certain that no more exist, but in the nearly equally long stretch of coast from Rio Grande do Norte to the Amazonas they may be presumed to be about as abundant and characteristic as in the section above mentioned, and it is much to be desired that this northern section should be examined in the same careful manner.

Dr. Branner, after fully describing and illustrating the reefs examined to the number of over twenty, sums up their characteristics as follows:

> The stone reefs are nearly but not quite straight. The bedding of the material dips seaward at the same angle as ordinary beach sands. The hard rock of the reef is only three or four meters thick. The underlying materials are sands, shells and clays without regular sequence. The process of formation, the character and the structure of the reefs show that they are ancient beaches hardened by lime carbonate, while their straightness shows that they are forms of a mature beach line fixed and made permanent by the process of consolidation pointed out in Part VI.

The most puzzling problem presented by these reefs is that of their consolidation through the deposition of lime carbonate, and one of the most interesting chapters of the memoir is devoted to its discussion. The hypothesis of the hardening of beach sands through the action of rain water and through the escape of carbon dioxide contained in sea water is admitted as possible, but put aside as insufficient to account for all the phases of the phenomenon. The coincidence of the distribution of the stone reefs with an area of greater density of the oceanic waters is noted as a possible concurrent cause. (Another coincidence worthy of note is that of the distribution of the sandstone and coral reefs.) A more efficient cause is thought to be the seeping of fresh water charged with organic acids from the decay of vegetable matter accumulated in the lagoons and repressed streams behind beach ridges. The reefs occur along a section of coast swept by tolerably constant winds and currents, and with such geologic and climatic conditions that many streams are temporarily or permanently closed by the formation of beach ridges, so that their waters, becoming charged with organic acids, have to find their way to the sea by percolation through the barriers of beach sands. In conclusion the author remarks: "It seems probable that the consolidation of the reef sands would not take place if the rainfall were large enough and constant enough to keep the mouths of the streams open and the waters of the streams fresh" [pure].

In a chapter on coast changes evidences of both elevation and depression in late geological times are presented and discussed. A depression of considerable importance is presumed to have taken place in early Pliocene times, followed by a smaller elevation. The sandstone reefs were formed and hardened subsequent to the depression, but there is no evidence that they have suffered any appreciable movement since their formation. The reefs, both sandstone and coral, have protected the land and helped build out the shores.

In an introductory chapter a brief sketch of what is known of the geology of the coast along which the reefs occur is given. In this Dr. Branner takes issue with his predecessors, and with his own previous writings, by referring to the Tertiary a considerable portion of what has been considered as Cretaceous. The evidence for this change of view is, however, confessedly inconclusive, and to the reviewer it seems that some contrary evidence of importance has been overlooked or unduly minimized.

The chapter on coral reefs is also a valuable

contribution to our knowledge of the physical and geological conditions of the same section of the coast, as hitherto the only scientific studies of the Brazilian coral reefs were those of Hartt on the reefs near the Abrolhos and of Rathbun on that of Itaparica in the bay of Bahia. The coral reef-fringed section of the Brazilian coast extends from near the equator to 18° south latitude, but for nearly half of this long line, from Rio Grande do Norte northward, the various types of reef—sandstone, coral and underlying rock—can not at present be discriminated. The coral reefs are broken by many and large gaps, for some of which no apparent reason can be given. With the exception of the Rocas, which seems to be a true atoll rising from deep water, all the reefs are built up on the submerged continental shelf and are fringing and barrier reefs. They are usually narrow, ten to fifty meters in width, but in the case of the large barrier reefs may attain a width of thirty kilometers. The near-shore reefs are quite thin, probably not exceeding a thickness of ten meters, and a hundred meters is presumed to be the maximum thickness of the outlying barrier reefs.

For the most part the reefs have reached the upper limit of growth and are now dead on top, though still growing laterally. None, however, are known that have been elevated above tide level. In age they are presumed to date back to Tertiary times, since they rise from a shelf due to a great depression presumed to be of early Pliocene date. Coral rock has been observed both beneath and on top of sandstone reef rock and possibly some coral reefs rise from a base furnished by submerged examples of sandstone reefs. The coral polyp fauna found on the reefs contains twenty-eight species and is more closely related to that of the West Indies than to any other known coral fauna.

One of the points of greatest geological interest brought out by this study of the coral reefs is that a process of dolomitization of the reef rock is going on in the open sea, thus rendering unnecessary the 'salt-pan' hypothesis that has been appealed to in the cases hitherto noted of a higher proportion of magnesia in rocks of coral origin than in the skeletons of the corals themselves.

Dr. Branner states that the opportunity for completing his reef studies, commenced many years ago, was provided by Professor Alexander Agassiz. Both these gentlemen are, therefore, to be congratulated on the importance of the results achieved and presented in this splendid memoir, and it is greatly to be desired that these results will stimulate them to promote a similar study of that biologic and geologic *terra incognita*, the northern section of the reef-bound Brazilian coast, which, on account of the peculiar conditions of winds and currents, can only be explored by the use of steam vessels.

Orville A. Derby.
Commissao Geographica e Geologica de São Paulo, Brazil,
December 26, 1904.

Scientific Journals and Articles.

The April number (volume 11, number 7) of the *Bulletin of the American Mathematical Society* contains the following articles: Report of the February Meeting of the American Mathematical Society, by F. N. Cole; Report of the December Meeting of the Chicago Section, by T. F. Holgate; 'Mathematics at the St. Louis Congress, September 20, 22 and 24, 1904,' by H. S. White; 'The Use of Hypercomplex Numbers in Certain Problems of the Modular Group,' by J. W. Young; 'Extension of a Theorem due to Sylow,' by G. A. Miller; 'Note on Isothermal Curves and One-Parameter Groups of Conformal Transformations in the Plane,' by C. L. Bouton; Review of Arendt's Dirichlet's Definite Integrals, by Virgil Snyder; 'The Theta Functions' (Review of Krazer's Thetafunktionen and Rost's Riemann'sche Thetafunktionen), by J. I. Hutchinson; Review of Hilton's Mathematical Crystallography, by R. P. Baker; 'The Theory of Electricity' (Review of Abraham and Föpple's Theorie der Elektricität), by E. B. Wilson; Notes; New Publications.

The April number (volume 6, number 2) of the *Transactions of the American Mathematical Society* contains the following papers:

E. J. Wilczynski: 'General projective theory of space curves.'

MAURICE FRÉCHET: 'Sur les opérations linéaires (deuxième note).'

E. KASNER: 'Surfaces whose geodesics may be represented in the plane by parabolas.'

MAX MASON: 'The doubly periodic solutions of Poisson's equation in two independent variables.'

O. VEBLEN: 'Definition in terms of order alone in the linear continuum and in well-ordered sets.'

S. EPSTEEN and J. H. MACLAGAN-WEDDERBURN: 'On the structure of hypercomplex number systems.'

E. H. MOORE: 'On a definition of abstract groups.'

E. V. HUNTINGTON: 'Note on the definitions of abstract groups and fields by sets of independent postulates.'

L. E. DICKSON: 'Definitions of a group and a field by independent postulates.'

L. E. DICKSON: 'On semi-groups and the general isomorphism between finite groups.'

E. V. HUNTINGTON: 'A set of postulates for ordinary complex algebra.'

H. F. BLICHFELDT: 'On imprimitive linear homogeneous groups.'

SOCIETIES AND ACADEMIES.

THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE.

THE eleventh regular meeting of the Society for Experimental Biology and Medicine was held in the zoological laboratory of Columbia University, on Wednesday evening, April 19. The president, Edmund B. Wilson, was in the chair.

Members present.—Adler, Auer, Calkins, Emerson, Gies, Hatcher, Jackson, Lee, Levene, Levin, Lusk, Meltzer, Morgan, Murlin, Richards, Salant, Sherman, Torrey, Wallace, Wilson, Wolf, Yatsu.

Members elected.—Harlow Brooks, W. B. Cannon, A. J. Carlson, R. G. Harrison, A. P. Mathews, G. H. Parker, A. E. Taylor.

ABSTRACTS OF REPORTS OF ORIGINAL INVESTIGATIONS.*

The Relation Between Normal and Abnormal Development of the Frog's Egg: T. H. MORGAN.

The method of development of the frog's egg may be changed by a number of external conditions, *e. g.*, treatment with salt solutions of definite strengths, variations of temperature, deprivation of oxygen, treatment with carbon dioxid, subjection to 180 revolutions per minute, etc. The effects of such external agents are not gradual, *i. e.*, corresponding in degree to the increasing strength of the agent employed, for no effects appear up to a certain point, when suddenly the agent begins to act. Increasing the strength of the agent above this point increases the effect very slightly. The most plausible explanation of this mode of behavior in most of the cases is as follows: The agents act by coagulating certain parts of the egg, thereby preventing their further development. Other parts of the egg that are made up of different colloids or of different concentrations of colloid, remain unaffected, and proceed to carry out their development as far as the presence of the injured region allows.

The author referred particularly, however, to a second point of special interest: Despite the great diversity in the form of the abnormal embryos, most of them may be reduced to modifications of the same type. He stated that the abnormal embryo develops in the material of the upper hemisphere, while the normal embryo develops over the lower hemisphere. Two interpretations of this difference seem possible. Either the material is totipotent and an embryo may develop anywhere in the egg, appearing in the less injured regions; or the material for normal and abnormal development is the same and becomes carried downward, during the early stage of normal development, from the upper into the lower hemisphere. A test of these alternatives showed that when the two upper anterior blastomeres are removed, the head end of the embryo is defective; when the two upper posterior blastomeres are removed the posterior end sometimes shows defects. When all four of the upper blastomeres are removed no embryo develops, although the blastoporic rim may appear near the equator of the egg, the gastrulation process may begin and the dif-

* The abstracts presented in this account of the proceedings have been greatly condensed from abstracts given to the secretary by the authors themselves. The latter abstracts of the reports may be found in current issues of *American Medicine* and *Medical News*.

ferentiation of the germ layers take place to a certain extent.

The author concluded from these results that some at least of the material that goes to form the embryo lies at first high up in the upper hemisphere of the egg. In the light of this conclusion it became necessary to examine once more the early development, especially the pregastrula stages, for no one has suspected that the embryo-forming material lies in the upper hemisphere and is transported to the lower hemisphere *before* the lips of the blastopore have appeared.

Briefly, the author's examination showed that throughout the early period of segmentation, the material of the upper hemisphere gets pushed far out to the sides of the egg. This is brought about largely by the development of the enormous segmentation cavity. During the later cleavage period the yolk cells of the lower hemisphere push upwards into the segmentation cavity, almost obliterating it. This upward movement of the cells in the interior is compensated for by the moving downwards below the equator of the outer layers of the egg. In this way the embryo-forming material is carried into the lower hemisphere. Along its edge the lips of the blastopore develop. The dorsal, lateral and ventral lips roll over the yolk (or more accurately, the yolk draws in beneath their advancing lips) and the dorsal organs of the embryo (the embryo in a narrower sense) appear over the lower or yolk hemisphere of the egg.

Rejuvenescence in Protozoa: Gary N. Calkins.

Since 1876 it has been generally assumed that one effect of conjugation is rejuvenescence or renewal of vitality in both of the ex-conjugants. This assumption has never been proved experimentally. In his Paramœcium work, begun in 1901, the author almost had the proof, but allowed the opportunity for obtaining it to pass without realizing it at the time. In order to complete the earlier work a new series of experiments with Paramœcium was started on the last day of February (1905), consisting of three different lines, at present in about the fortieth generation after conjugation. In his original experiments the author found strong evidence against the old view that both ex-conjugants are rejuvenated. In twenty pairs which were cultivated after separating from conjugation, at least one individual of each pair invariably died before many days, thus indicating an incipient fertilization like that in metazoa. This phenomenon will be given careful study in the experiments now under way.

Temperature and Muscle Fatigue: Frederic S. Lee.

Lohmann has recently claimed that a cold-blooded muscle on being heated to a mammalian temperature shows a course of fatigue similar to that of mammalian muscle, and, on the other hand, that a warm-blooded muscle on being cooled fatigues like the muscles of cold-blooded animals at a similar temperature. The author was unable to confirm Lohmann's results, and maintains his own previous conclusion that the contraction process of the muscles of cold-blooded animals in the course of fatigue becomes greatly slowed, while those of warm-blooded animals show no such phenomenon. The muscles of the frog and the turtle show their characteristic method of fatigue whatever the temperature. The muscles of warm-blooded animals on being cooled and then fatigued show either no slowing of the contraction process or only a slight slowing. The latter seems to be most pronounced in the rodents, namely, the rabbit, mouse and rat.

On Intraureteral Pressure and its Relation to the Peristaltic Movements of the Ureter, with demonstrations. Daniel R. Lucas. (By invitation.)

The author has observed that suction normally follows the peristaltic wave of the ureter; at the same time a force is exerted on the fluid in front of the wave. The force of the peristaltic wave was seen to raise a column of water of considerable height. When the ureter is acting normally, the pressure in the pelvis of the kidney remains constantly negative, the anatomical arrangement of the pelvis preventing collapse under negative pressure. These facts indicate that the ureter functions, to some extent at least, as an active agent in

the formation of urine, for the latter is in part a filtration process.

Further Observations upon the Phosphorized Fats in Extracts of the Kidney: EDWARD K. DUNHAM. (Presented by P. A. Levene.)

The author has found that beef kidney yields protagon to the extent of 0.14 to 0.2 per cent. of its weight (fresh). The protagon was obtained by the method recently used by Cramer (*Journal of Physiology*, 1904, XXXI., p. 31). On comparison with the protagon obtained by the same method from beef brain, it was found that the substance from the kidney contained distinctly more nitrogen and phosphorus than that from the brain. The cleavage products, however, showed that both substances are closely related. The following percentage analytic data were obtained by Dr. Levene:

	From Beef Kidney. (1)	(2)	From Beef Brain.	Cramer's Data for Beef Brain Protagon.
C	65.61	65.55	65.76	66.25–66.42
H	11 00	11.09	10.66	10 82–11.07
N	3.16	3.25	2.51	2.29
P	2 06	2.19	0.97	1.04
S	0.82	—	1.33	0.71

Comparative Physiological Action of Salts of Neodymium, Præseodymium and Lanthanum: B. J. DRYFUSS and C. G. L. WOLF.

The experiments were carried out in vitro and on unicellular organisms, bacteria and infusoria, frogs, pigeons, rats and guinea pigs. The solutions used were chiefly the chlorids, isotonic with 0.6 per cent. sodium chlorid. Dilute solutions were found to delay the growth of bacteria and eventually to kill. The solutions were not very toxic to spores. Opalina, paramœcia and vorticellæ were killed quickly, equivalent solutions of the chlorids acting in the following order of strength: neodymium, præseodymium and lanthanum. In frogs, voluntary and involuntary muscle are quickly put out of action. The solutions act in the same order as with unicellular organisms. Intravenous injection caused almost instant death, due to multiple embolism. Attempted chronic poisoning gave unsatisfactory results. The authors attribute a large share of the acute effects observed to the acid present in their solutions owing to the hydrolytic dissociation of the salts.

The Influence of Bile upon Blood Pressure: S. J. MELTZER and WILLIAM SALANT.

The authors found that all degrees of effects could be produced at will, from an insignificant one to a considerable, even a fatal, fall of blood pressure. Besides the quantity and the concentration of the bile it was found that the *rate* at which it is introduced into the circulation is the most effective factor in the result. A quantity of bile of a given concentration, which, when injected *slowly*, would cause only an insignificant depression, brought about a very great fall of the blood pressure when injected *rapidly*. In control experiments it was found that the mechanical and thermal conditions attending the injections had no observable influence on the pronounced effects noted above. Previous conflicting statements regarding the influence of bile on blood pressure may be attributed, therefore, to results due to different *rates* of injection. This factor, clearly recognized in other connections, had always been ignored in this.

It is probable that the bile exerts an inhibitory effect upon the heart. The authors have shown that the action on the heart is not due to malnutrition caused by hemolytic influences.

A Report of Feeding and Injection Experiments on Dogs after the Establishment of the Eck Fistula: P. B. HAWK. (Presented by A. N. Richards.)

Mixed diets were not attended by abnormal symptoms. Diets consisting of beef meal and milk or of fresh lean beef alone were followed by ataxia, loss of sight and hearing, complete anæsthesia and catalepsy. In some cases, however, these effects were noted only after the addition of Liebig's extract to the meat diet. The administration to normal dogs of sodium carbamate, either by mouth or by intravenous injection, gave rise to none of the symptoms observed by Pawlow and Nencki.

On Chemical Fertilization: JACQUES LOEB. (Presented by William J. Gies.)

The author found that when unfertilized eggs of the sea urchin were exposed for about

one to two minutes to 50 c.c. of sea water, to which about 3 or 4 c.c. of $n/10$ acetic acid had been added, the majority of the eggs formed the membrane characteristic of the entrance of the spermatozoon. When these eggs were exposed for from thirty to forty minutes to 100 c.c. of sea water to which 14 or 15 c.c. of a $2\frac{1}{2}$ n solution of sodium chlorid had been added, those of the eggs which had formed membranes developed into swimming larvæ that rose to the surface. These larvæ developed into perfect plutei as fast as the larvæ of eggs fertilized with sperm. When the order of treatment was reversed, not a single larva was formed. When eggs were fertilized with sperm first and then exposed to the hypertonic sea water for from about thirty to forty minutes, their development became almost identical with that of the unfertilized eggs treated first with acid and then exposed to the hypertonic sea water for the same period of time.

The acid treatment above referred to causes the formation not only of the membrane, but also, in due time, of the karyokinetic spindle. Eggs exposed for only thirty or forty minutes to the hypertonic sea water do not show any changes of any kind. Following the action of the acid, however, treatment with hypertonic sea water appeared to accelerate the mechanism of cell division originated by the acid treatment, and also seemed to increase the vitality or to prolong the life of the egg.

William J. Gies,
Secretary.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

The 599th meeting was held April 1, 1905.

In a communication made by Mr. R. A. Harris, entitled 'A General Account of the Tides,' brief mention was made of the disturbing forces and the ordinary ways of producing the tide. A small deep body of water may obey the equilibrium theory, *i. e.*, its surface may always be normal to gravity as disturbed by the moon or sun. This theory nearly explains the tides in Lake Superior, the eastern half of the Mediterranean Sea, the southwestern portion of the Gulf of Mexico and of the Caribbean Sea. The ocean tides are due chiefly to stationary waves, or oscillations, existing in such portions of the ocean as have for free period approximately the period of the tidal forces. The motion is thus sustained on a considerable scale, just as is the motion of the air particles in a resonator tuned to a sound of constant pitch.

The principal systems for the semidaily tide were shown on maps, and attention called to the loops and nodes of the oscillating areas. By means of maps of cotidal lines (taken from the Coast Survey Report for 1904) it was shown that over wide areas the tide is nearly simultaneous, while in certain localities the time of tide changes rapidly. In many instances the former regions correspond to loops of the stationary waves, while the latter give indications of nodal lines. Attention was called to isolated points at which there is no rise and fall of tide. Around such points the hours, or times, of the tide run through a complete cycle of values, from 0 to XII. or 0. Such points may be due to the superposition of stationary waves, or to other forms of wave motion; in narrow bodies the deflecting force of the earth's rotation is influential in their production. It was shown that both times and ranges give evidence of the existence and location of these points.

Mr. John F. Hayford then spoke on 'A Test of Isostasy from Geodetic Observations.' According to the theory of isostasy excesses of mass represented by portions of the earth which are above sea level are compensated for by defects of density beneath them, and similarly the density is excessive beneath the oceans. The test referred to is being made in connection with a new computation of the figure of the earth based upon geodetic observations in the United States, which is now in progress in the Coast and Geodetic Survey. The test furnishes a direct proof that the theory of isostasy is true as applied to the northeastern portion of the United States, and also furnishes a determination of the depth of compensation.

Charles K. Wead,
Secretary.

THE BIOLOGICAL SOCIETY OF WASHINGTON.

The 399th regular meeting of the Biological Society of Washington was held March 11,

1905, with President Knowlton in the chair and eighty-seven persons present. Under 'Notes and Exhibition of Specimens,' Dr. L. O. Howard exhibited specimens of various products of artificial silk, and briefly explained the process of preparation and weaving. This note was discussed by Mr. W. P. Hay. Mr. E. L. Morris called attention to the recently issued edition of Cassino's 'Naturalists' Universal Directory'; and noted the very large number of errors which are scattered through the work. He suggested the advisability of the scientists in a city like Washington taking some steps to have such errors as much reduced in number as possible. Mr. F. H. Blodgett exhibited a microscope slide of a common ant mounted in toto, in xylol and balsam, in normal position, showing clearly such anatomical characters as the attachment of the head to the thorax. This preparation was discussed by Mr. Morris. President Knowlton called attention to a recent paper containing facts concerning the salts found in human blood.

The regular paper of the evening was by Professor Willett M. Hays, assistant secretary of agriculture, on 'Breeding Problems.' He said:

Of the $5,000,000,000 worth of agricultural products annually produced in the United States, $4,000,000,000 worth is handled by plant and animal life. This production may be increased by (1) better farming ten per cent. and (2) by breeding ten per cent. Increased returns from better farming cost more than equal increased returns from breeding. Ten per cent. of $4,000,000,000 is $400,000,000 and this can be produced at a cost very small as compared with the total increase.

Improvements through breeding can not be patented or monopolized. The problem, therefore, is a national one and national funds should be forthcoming with which to facilitate the work of investigation, growing, testing, recording and distributing improved varieties and breeds. The work already done by the Department of Agriculture, the experiment stations and by private effort sufficiently justifies such large expenditures, and the money is not far off. It would seem wise to have the ownership of the plants and animals under process of improvement vested in private hands, the government giving general direction and subsidizing the operations.

A broad plan of cooperation must be worked out. Plant and animal breeders are well started in cooperation through the medium of the American Breeders' Association, organized a year ago and soon to publish its first annual report.

The problems in breeding now up for solution are worthy of the highest scientific effort. The technique of breeding, growing and distributing pure bred stocks of the different crops and animals calls for skill and business ability of a high order. The study of thermatology in agricultural high schools and colleges is fascinating and most valuable. The economic importance of breeding demands serious attention from the whole people.

THE 400th regular meeting of the Biological Society of Washington was held March 25, 1905, with Vice-President Hay in the chair and seventy-seven persons present. Under 'Notes,' Mr. M. W. Lyon, Jr., spoke of having observed twelve dead crows during a short walk in the Soldiers' Home grounds, and commented on the large number for so small an area. Dr. B. W. Evermann stated that three weeks previous, in a grove of pines, he had observed seven. Dr. E. A. Mearns noted that such deaths were epidemic, especially in the neighborhood of Fort Meyer. Many of the specimens observed had been sent to the Smithsonian Institution as probable cases of malarial fatality. Mr. William Palmer stated that after every snow, especially if more than two weeks' stand, the crows died by the score. Dr. L. O. Howard emphasized the fact that these were largely malarial cases. Mr. W. L. McAtee called attention to the large amount of food suitable for birds he had noted during the winter in heaps of drift. He stated that in one heap alone he had counted 1,583 specimens of seeds, etc., all of which were available as bird food.

The first regular paper of the program was

by Dr. Hugh M. Smith, presenting 'Ichthyologia Miscellanea' as follows:

1. The proper name for the blue-gill sunfish. This species is now known as *Lepomis pallidus* (Mitchill). Dr. Smith showed that Mitchill's name *pallidus* (1815) can not be appropriated for this fish, as the description does not apply and the species is not found near New York City, the type locality of *pallidus*. The earliest available name for this sun-fish is *incisor* of Cuvier and Valenciennes (1831), and the species should be known as *Lepomis incisor* (Cuvier & Valenciennes).

2. Note on a rare flying-fish (*Cypselurus lütkeni*). The speaker recorded the capture of the second known specimen at Beaufort, N. C., in 1904. The source of the type specimen, now in the Philadelphia Academy of Sciences, is doubtful, but the indications are that it, too, came from Beaufort about 1871.

3. The feeding habits of the trigger fish (*Balistes vetula*). These habits had been observed on a captive specimen at the Woods Hole Laboratory. Dr. Smith described in detail how this fish attacked, killed and ate its food consisting largely of a certain species of crab.

This paper was discussed by Dr. Evermann.

The second paper was by Mr. A. G. Maddren, 'Notes on the Occurrence of Mammoth Remains in Alaska.'

In introductory remarks an outline was given of a trip the speaker made last summer in the interests of the Smithsonian Institution to Alaska with the purpose of searching for the remains of large Pleistocene mammals, particularly those of the mammoth, which are popularly supposed to be abundant in that region, but actually do not exist in any great numbers. The entire length of the Yukon River was traversed and one of its largest tributaries, the Porcupine, was ascended to the Old Crow River, in the basin of which stream abundant evidence of Pleistocene mammal remains were found.

Attention was called to the fact that Pleistocene mammal remains appear to be no more abundant in Alaska than in the United States, and to find complete remains of the mammoth and associated mammals search must be made around the former shore lines of the Pleistocene lacustrine deposits that are considerably developed in Alaska.

A historical summary of the records of the occurrence of mammoth remains in Alaska was given and the statement made that there is no formation of ice in Alaska that may be assigned to the Pleistocene age, as has been stated by some writers, but that all the ice phenomena there occurring are, geologically, comparatively recent.

The concluding remarks favored the view that Alaska, from a geographical standpoint, was in Pleistocene time part of Asia; that its fauna had closer affinities to that of Asia than to the contemporary fauna of the United States and that if sufficient material were at hand to institute a close study it would be found that *Elephas primigenius,* the true Siberian mammoth, never lived in the United States, which was occupied by three distinct species of fossil elephants, the form most closely related to the Siberian mammoth (*E. primigenius*) being *Elephas jacksoni,* the others being the more easily distinguished forms *Elephas columbi* and *Elephas imperator.*

The last paper was by Dr. A. D. Hopkins on 'Ornaments and Blemishes in Wood, Caused by Insects and Birds.'

Dr. Hopkins stated that the object of the paper was to discuss the causes of some of the ornamental conditions and blemishes commonly seen in the wood of trees and their crude and finished products.

The blemishes appear in lumber and wood-finish as discolored spots, checks, dark stains, resin deposits, pin holes, worm holes, etc., and in the trees as scars, decayed spots and hollow trunks.

The ornamental conditions appear in the lumber and inside finish and furniture as so-called bird's-eye, curly, burl and wavy or satined effects, and on the surface of the wood beneath the bark as artistic and curious carved and embossed work.

It would be difficult to find a recently constructed public building or private residence which does not show in the natural wood finish one to many blemishes, the results of many causes. Most of them, which are not

natural conditions in the wood, are caused primarily by insects, birds and various other agencies, which produce wounds in the cambium of the living tree. When we are able to identify these blemishes with the species of bird or insect that caused them, they become objects of interest. Certain bird's-eye and curly effects are even more interesting, because more pleasing to the eye, and the exact cause is more obscure.

The object of the study of woodpecker work in living trees was to determine characters by which the subsequent results from wounds made by them in the living cambium could be identified from those caused by insects and other agencies; also to determine the relation of the birds and their work to subsequent injuries by insects, or the reverse.

The material collected by him during the past fourteen years represents some forty species of forest trees, of many genera and families, and from widely different sections of the country.

It appears that the object of the sapsucker working in the bark of living trees is to secure both liquid and solid food from the sap, cambium and bast, and not for the purpose of collecting insects, or, at least, not primarily for that purpose.

The punctures in the bark vary in size, form and arrangement, according to the species of tree and the character of the food furnished. In the pine, spruce, hemlock, juniper, and probably in all conifers, the desirable substance is furnished by the living bast tissue and cambium, while the wood yields resin instead of sap, therefore the birds have no occasion to puncture the outer wood-ring, and very rarely do so, whereas in maple, walnut, hickory and such trees as furnish at certain times of the year a prolific flow of saccharine sap from the sapwood, the outer ring of wood is always punctured. In the former, the wounds are usually broad, often connected, and usually arranged in longitudinal rows, while in the latter they are narrow, funnel-shaped, rarely joining, and arranged in transverse rows.

The method of healing of these wounds is quite variable, being influenced not only by the character of the wound, but by the species or genus of trees in which they occur.

The resulting defective or ornamental conditions and subsequent annual layers of wood also vary in character and economic importance with different kinds of trees and commercial products.

While the healed wounds made by the birds cause a bird's-eye effect in the finished surface, they are not responsible for all bird's-eye wood. The small densely placed bird's-eye in maple is not caused by birds, but appears to be a character peculiar to certain individual trees, while that resulting from the work of birds is coarser, less distinctly defined, more sparsely arranged, and the wood in which it occurs usually shows small dark spots or streaks where the original wound was made in the living cambium.

Specimens of blemishes, bird's-eye and stained effects caused by birds and insects in many kinds of wood were shown, together with some forty stereopticon slides.

Attention was called to the knotty walking sticks, umbrella handles, crops, etc., which represent an extensive industry, in which the desired knotty effect is produced artificially by making wounds with a sharp instrument in the living bark and cambium of the growing stem, which is left to grow one year and heal the wounds before cutting the stick and removing the bark. This result is similar to that from a wound made by a sapsucker, which may have suggested the idea.

E. L. MORRIS,
Recording Secretary.

MICHIGAN ORNITHOLOGICAL CLUB.

THE annual meeting of the Michigan Ornithological Club was held in the museum of the University of Michigan at Ann Arbor on April 1, 1905. A business meeting was held in the forenoon in the curator's office. The following officers were elected for 1905–6.

President—Walter B. Barrows.
First Vice-President—A. H. Griffith.
Second Vice-President—James B. Purdy.
Third Vice-President—J. Claire Wood.
Secretary—Alexander W. Blain, Jr.
Treasurer—Frederick C. Hubel.

Editorial Staff of the Bulletin: Editor, Walter B. Barrows; *Associates*, P. A. Taverner, Norman A. Wood.

The afternoon session was held in the university lecture room. The meeting was called to order by Professor Barrows, who addressed the society on 'Recent Advances in Ornithology.' The following program was then presented:

Leon J. Cole: 'In Memoriam—Albert Bowen Durfee' (read by J. Wilbur Kay in the absence of the author).

Norman A. Wood: 'Birds noted En route to Northern Michigan.'

Otto McCreary: 'Ecological Distribution of tne Birds of the Porcupine Mountains, Michigan.'

Max M. Peet: 'Observations on the Nesting Habits of a Pair of House Wrens.'

Alexander W. Blain, Jr.: 'On the Use in Surgery of Tendons of the Ardeidæ and Gruidæ.'

Norman A. Wood: 'Some New and Rare Records for Michigan.'

Earl H. Frothingham: 'A List of Birds from the Michigan Forest Reserve, Crawford County.'

Leon J. Cole: The Occurrence of Bewick's Wren, *Thryomanes bewickii* (Aud.), at Grand Rapids (read by Wm. H. Dunham).

P. A. Taverner: 'A Preliminary Notice of an Interesting Migration Route.'

Alexander W. Blain, Jr.,
Secretary.

THE AMERICAN MYCOLOGICAL SOCIETY.

The American Mycological Society met in affiliation with the American Association for the Advancement of Science at Philadelphia, December 28–31. The following officers were elected:

President—Charles H. Peck.
Vice-President—F. S. Earle.
Secretary-Treasurer—C. L. Shear.

The following committee on organization and relation to the other societies was appointed by the president: C. L. Shear, S. M. Tracy and Dr. Roland Thaxter.

The following program was presented:

Charles Thom: 'Suggestions for the Study of Dairy Fungi.'

Geo. G. Hedgcock: 'A New Disease of the Cultivated Agave.'

J. C. Arthur: 'A Study of North American Coleosporiaceæ.'

E. J. Durand: 'Classification of the Geoglossaceæ.'

J. C. Arthur: 'The Terminology of the Spore Structures in the Uredinales.'

E. A. Burt: 'Generic Characters of North American Thelephoraceæ.'

Perley Spaulding: 'Cultures of Wood-Inhabiting Fungi.'

G. F. Atkinson: 'Two Fungous Parasites on Mushrooms.'

G. F. Atkinson: 'The Genus *Balansia* in the United States.'

DISCUSSION AND CORRESPONDENCE.

AUBUBON'S ACCOUNT OF THE NEW MADRID EARTHQUAKE.

Within the last few years there has been a reawakening of interest in the New Madrid earthquakes as evidenced by the papers of Dr. W J McGee in the fourth volume of the Geological Society of America, Dr. G. C. Broadhead in the *American Geologist* in August, 1902, and Professor E. M. Shepard in January–February number of the *Journal of Geology* of the present year. In Broadhead's paper are given abstracts of a considerable number of contemporaneous and other early publications on the earthquake phenomena, but the description by Audubon seems to have been overlooked. As he was one of the few, quite possibly the only, scientist who was in the region at the time, his account is of interest. It is of significance that it agrees very closely with the descriptions of many of the residents, indicating that the accounts are probably not so distorted as has sometimes been thought. Audubon's description is in part as follows:*

> Traveling through the Barrens of Kentucky * * * in the month of November [1812],† I was jogging on one afternoon, when I remarked a sudden and strange darkness rising from the western horizon. Accustomed to our heavy storms of thunder and rain I took no more notice of it, as I thought the speed of my horse might enable me to get under shelter of the roof of an acquaintance, who lived not far distant, before it should come up. I had proceeded about a mile, when I heard

* 'Audubon and his Journals,' Vol. II., pp. 234–237, Charles Scribner's Sons, New York, 1897.

† The first of the series of shocks was on December 16, 1811.

what I imagined to be the distant rumbling of a violent tornado, on which I spurred my steed, with a wish to gallop as fast as possible to a place of shelter; but it would not do, the animal knew better than I what was forthcoming, and instead of going faster, so nearly stopped that I remarked he placed one foot after another on the ground, with as much precaution as if walking on a smooth sheet of ice. I thought he had suddenly foundered, and, speaking to him, was on the point of dismounting and leading him, when he all of a sudden fell a-groaning piteously, hung his head, spread out his four legs as if to save himself from falling, and stood stock still, continuing to groan. I thought my horse was about to die, and would have sprung from his back had a minute more elapsed, but at that instant all the shrubs and trees began to move from their very roots, the ground rose and fell in successive furrows, like the ruffled waters of a lake, and I became bewildered in my ideas, as I too plainly discovered that all this awful commotion in nature was the result of an earthquake. * * * The fearful convulsion, however, lasted only a few minutes, and the heavens again brightened as quickly as they had become obscured; my horse brought his feet to their natural position, raised his head, and galloped off as if loose and frollicking without a rider. * * * Shock succeeded shock almost every day or night for several weeks, diminishing, however, so gradually as to dwindle away into mere vibrations of the earth. Strange to say, I for one became so accustomed to the feeling as rather to enjoy the fears manifested by others. * * * The earthquake produced more serious consequences in other places. Near New Madrid and for some distance on the Mississippi, the earth was rent asunder in several places, one or two islands sunk forever, and the inhabitants fled in dismay towards the eastern shore.

M. L. FULLER.

U. S. GEOLOGICAL SURVEY.

SUGGESTIONS FOR FACILITATING THE WORK OF ZOOLOGISTS.

Two plans have occurred to me which would, I think, considerably lighten the work of zoologists if they could be carried out. As they do not seem wholly impracticable, I venture to present them for consideration and discussion.

1. No generic name is allowed to be used twice in zoology; so that when any name is used a second time, by inadvertence, it falls as a homonym, and a substitute has to be proposed. As a matter of fact, the literature swarms with such homonyms, and we are constantly finding ourselves under the necessity of making changes because of them. Now that we have Scudder's 'Nomenclator' and Waterhouse's 'Index,' bringing the list of names proposed up to 1900, it ought to be quite possible to overhaul the whole series up to date, and make a list of *all* the homonyms known. If such a list were made in manuscript it might be divided into minor series according to the groups of animals, and each of these sent to a specialist in the group concerned. These specialists might then go carefully over the lists, seeking the advice and assistance of colleagues, and sift out all the names for which substitutes had already been proposed, and those which stood for invalid genera, leaving a residue of homonymous names for valid genera to be dealt with. This residue would have to be again examined to see whether any other names, hitherto placed in the synonymy, could be substituted, and when this could not be done new names should be proposed. This would involve a great deal of work, but it would get rid of the trouble from homonyms once for all, so far as the past is concerned; except, of course, those resulting from names overlooked in the indices. It would save us from the present sense of insecurity regarding names, and from a great deal of duplicated labor in looking up the names in use, lest they should be preoccupied. If the full list were published, it would also prevent the proposal of new substitutes for names which had already been suitably replaced on account of homonymy.

Such a work ought to be cooperative; because it could not be done well—even the first part, of matching names and detecting homonyms—by persons unfamiliar with scientific names; while it would not be reasonable to expect a working zoologist to devote his time to it to the exclusion of his original investigations. If each letter, in the first part of the work, were undertaken by one individual, it would not be long before it might be finished. For the later investigations, specialists would have to be allowed to take their

own time; but the groups first done could be published, without waiting for the others. The publication of the lists would be rather expensive, and would have to be undertaken by some institution. Whether the work itself could be done by volunteers, I do not know; but if any money could be obtained in payment for it, it would probably be easier to find workers.

2. At present new species of animals are described in all sorts of publications, in consequence of which it often becomes expensive or difficult to obtain the descriptions relating to any one group. It might be a very good plan if all descriptions of new species and varieties of North American animals were published (or republished) in a single series, on leaflets somewhat like those issued by the Biological Society of Washington. It might be so arranged that each leaflet should include only a single species or variety, or perhaps only those of a single genus, and each might be sold at a stated price. One could then subscribe for all the new descriptions pertaining to a certain genus, family or order, and receive them immediately upon publication. They could be bound up, when numerous enough, in any way that proved convenient; *e. g.*, all the new animals from Colorado, or all the new mammals from North America. The descriptions should, of course, be published promptly, and strictly in the order of their receipt at the editorial office. All descriptions of reputable authors should be accepted, but it would be appropriate to make certain rules, applicable to all; thus it might be required that the descriptions should be reasonably complete, or not conspicuously incomplete; that the exact locality and collector's name should be given, if ascertainable; and that comparison should be made with allied species. The same plan would be equally applicable to plants, of course. A special series of leaflets, issued with the others, might be devoted to the proposal of synonymy, or of new combinations. How much financial support such a plan would require I do not know; perhaps it would pay for itself, or nearly. It would probably not be necessary to take any special steps to persuade authors to send their new descriptions for publication in the leaflets; the majority would doubtless soon do so as a matter of course, while those who did otherwise would find their descriptions reprinted in the regular series.

T. D. A. Cockerell.

Boulder, Colorado.

SPECIAL ARTICLES.

A CARD INDEX STOCK LIST FOR USE IN UNIVERSITY DEPARTMENTS OF ORGANIC CHEMISTRY.

One of the administrative difficulties confronting the head of a university department of organic chemistry is the proper listing of the great variety of chemicals carried in stock, and constantly accumulating year by year as the result of the various investigations conducted in the laboratory. The troubles of the organic chemist in this respect are much greater than those of his inorganic colleague, for he must carry in stock not only about all the chemicals required by the inorganic chemist, but his own innumerable organic chemicals as well. In the larger universities, this accumulation of stock in the departments of organic chemistry amounts to many thousand lots, generally distributed in various rooms—the general stock rooms and closets, the main laboratory, the research rooms, the rooms of the officers of the department, the chemical museum, and elsewhere; in all kinds of containers, large and small, boxes, crocks, bottles, specimen tubes, and the like. To classify and list this mass of scattered material in such a way that an instructor can tell in a few moments whether a certain chemical is available in the department, and if so, in what amount and quality, and, further, to keep such a list constantly up to date, in spite of daily removal of stock and addition of new material, is not a simple task, as I think most of my colleagues will admit. And yet, without such a list more or less confusion is likely to result, and much valuable time will be wasted in pawing over a lot of bottles or specimen tubes in a vain search for a compound which is not in stock at all or can not be found, or, in other cases, for substances which, when found, prove to be too impure or too small in amount to be of any use. In this country, the failure to keep

accurate track of stock available is more serious in the case of organic compounds than of inorganic, for the latter can usually be secured here of satisfactory quality, but, with the exception of the very commonest, practically all fine organic chemicals must be imported from Germany. As it takes about two months for such importations, a serious delay may thus be caused in the prosecution of a research, the only escape from which is for the investigator to turn in and make the substance himself.

We have not found it necessary to index our inorganic stock, for this can be satisfactorily classified by keeping all the compounds of the same element together, and arranging the elements alphabetically on the shelves of the stock room. We have found it necessary, however, to index our organic stock, with the exception of the reagents on the laboratory shelves.

That an alphabetical classification of organic substances is not very satisfactory will, I think, be readily admitted by all organic chemists, particularly by those who have had occasion to search for compounds in Watts's Dictionary. No doubt every method of classification has its shortcomings and inconsistencies, but for purposes of indexing we have found the 'Beilstein' classification most satisfactory, for the reason that when in doubt we can always refer to this standard work, or to Richter's 'Lexikon,' which latter constitutes a complete general index to Beilstein. In order to record location of stock, our rooms are all numbered, and when necessary the shelves (from top to bottom), rows (from back to front) and individual bottles (from left to right) also. Thus '406, 16, 1, 10' would mean—room 406, shelf 16, row 1, bottle No. 10. It is not necessary often to elaborate quite so much as this—for increased elaboration means diminished freedom of arrangement on the shelves—but we have found it helpful in the case of deep shelves in dark corners, and it then becomes necessary to supplement the general index by a special shelf list, to prevent and correct any disarrangement of stock on the shelves.

The index is a card catalogue, composed of

Name, *p*-Amino Benzonitrile, II, 1273.

Formula, $C_7H_6N_2 = C_6H_4\begin{matrix}CN\ (1)\\NH_2\ (4)\end{matrix}$ = M. P., 86°.

B. P.

Amount.	Maker.	M. P.-B. P.	Location.	Cost.	Remarks.	Date.
10 gm.	L. Kohnstamm.	86°	Museum.		Reduction of nitro nitrile.	1902
0.7 "	"	"	408 N.		Engler's method; Zn + HCl.	"
1.0 "	"	"	"		$SnCl_2$ + HCl.	"
0.5 "	"	85.6	"		Fricke's method; Sn + HA.	"
0.2 "	Ferrero.	85–85.5	"		*p*-uramino benzoic acid + P_2O_5	"
50 "	Williamson.	86	405		Reduction of nitro; c. p.	1903

5″ x 8″ cards. The Macey cards are by far the most convenient, as their side locking system permits the removal of any card, by a half turn of the locking rod, as rapidly as though the cards were not locked in at all. A sample card is shown herewith. These cards are arranged in drawers in the 'Beilstein' order, colored guide cards indicating the divisions of the classification. The numbers (II., 1273) in the upper right-hand corner indicate the volume and page of Beilstein's 'Handbuch' (third edition) where the compound will be found described in detail. This has the further advantage that when one does not remember off-hand in just which group a certain compound is classified, all that is necessary is to get the volume and page reference from Beilstein and it can then be found very quickly in the index. In other words, the paging (if it may so be termed) of the index is identical with that of Beilstein. The melting-points (M. P.) and boiling-points (B. P.) provided for in the upper right-hand corner are those recorded in the literature, while those in the column near the middle of the card represent the actual melting-points or

boiling-points of the various samples listed; a comparison of the two will, therefore, indicate the probable purity of the different samples. It is obvious that such a card properly filled out will give the instructor at a glance all the information desired concerning his stock.

I think that I hear the reader saying to himself, 'All very pretty! but it must take an immense amount of time to get up such a list, and it would be perfectly hopeless to attempt to keep it up to date!' It is quite true that it does take some time to prepare such a list, particularly where the mass of material is great, but the time thus lost is very quickly made up by the time saved in the use of the index, and when once done it does not have to be done over again. I assume that every laboratory finds it desirable to take a complete account of stock at least once a year. As to the other objection—keeping such a list up to date, our method is as follows: Two sets of printed blanks are used, about 3″ x 5″, one printed on blue paper, the other on white. One is for stock removed, the other for new stock. On the blanks headed 'Removed' are the following items—substance, amount, maker, location, date, for; on the 'New Stock' blanks—substance, amount, maker, cost, location, date. Whenever any chemical is removed from stock for use in a research, to replenish a reagent bottle, or for whatever purpose, one of these 'Removed' blanks is filled out and put on file, and once a month or so these blanks are checked up and the index corrected accordingly. After correcting the index, the blanks are not destroyed, but are kept on permanent file, and at the close of the year an examination of the total blanks on file will show exactly how much and where the stock is most in need of replenishing, thereby furnishing the necessary information for the preparation of the annual import order. The 'New Stock' blanks should also be placed on permanent file after having been entered in the index. It will be found more convenient, in both cases, to use a separate blank for each separate bottle.

Such a general stock list is not only a perpetual inventory, but it may also do duty as a chemical museum catalogue, and be useful in other directions also. For example, it will show instantly any change in the market price of the chemicals listed, and perhaps thus lead occasionally to the correction of unintentional overcharges on the part of dealers. When once made, it requires only occasional attention, and the addition of new cards for new substances. Wherever possible, as in the chemical museum and general stock rooms, the stock should be arranged in the same order as in the index.

As the above method has appeared to interest so many of our brother chemists both here and abroad, I have taken this opportunity of making it available to all, in the hope that others may find in it something useful or suggestive. It has been in use in the department of organic chemistry of Columbia University for several years, and has been of very great assistance to us in our work.

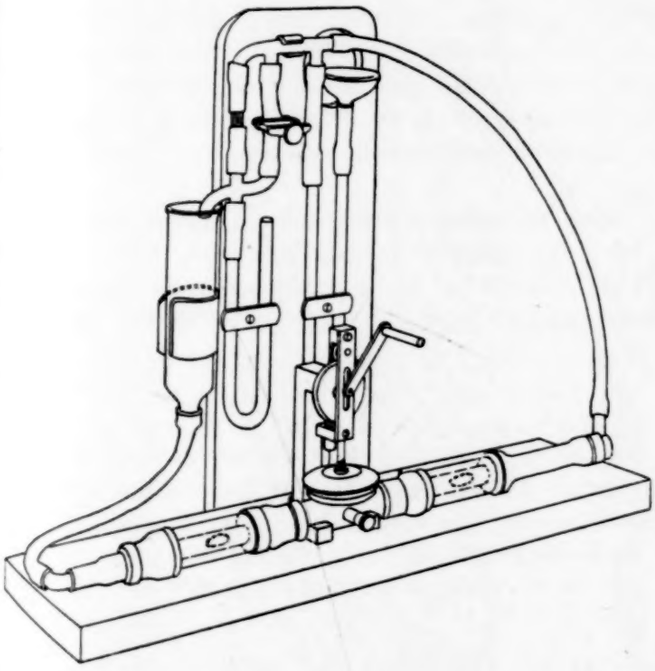
Marston Taylor Bogert.
Havemeyer Laboratories,
Columbia University,
March 30, 1905.

A QUANTITATIVE CIRCULATION SCHEME.

The artificial scheme (Fig. 1) to illustrate the mechanics of the circulation in the highest vertebrates consists of a pump, a system of elastic tubes and a peripheral resistance. The inlet and the outlet tubes of the pump are furnished with valves that permit a flow in one direction only. The peripheral resistance is the friction which the liquid undergoes in flowing through the minute channels of a piece of bamboo. To this must be added the slighter resistance due to friction in the rubber and glass tubes.

In this system the pump represents the left ventricle; the valves in the inlet and outlet tubes, the mitral and aortic valves, respectively; the resistance of the channels in the bamboo, the resistance of the small arteries and capillaries. The tubes between the pump and the resistance are the arteries; those on the distal side of the resistance are the veins. The side branch substitutes a wide channel for the narrow ones, and thus is equivalent to a dilatation of the vessels.

The pressure in the ventricle is varied through a tambour covered with rubber membrane. The membrane is grasped between two disks, one below and one above. The upper disk is screwed down upon the lower until the membrane is tightly held. To these disks is fastened a rod which ends in a yoke. The yoke rests upon a small wheel, which in turn is supported by a brass plate eccentric in form. This brass plate is revolved by turning a handle attached to the axle. As the plate revolves the small wheel bears upon the eccentric rim and rises and falls with the rise and fall in the rim of the plate. The motion of the small wheel is transferred through the yoke, rod and disk to the rubber membrane and thus to the interior of the ventricle.



The rim of the eccentric brass plate reproduces the intraventricular pressure curve in the dog. In projecting this curve upon the plate the periphery is divided into fractions of a second and the radii are divided into millimeters of mercury pressure.

Each revolution of the eccentric plate reproduces in the ventricular tube both the time and the pressure relations of the ventricular cycle in the dog. The intraventricular pressure curve may be written by connecting the side tube with a membrane manometer, and clamping off the arterial mercury manometer to be mentioned shortly.

When the pressure rises in the ventricle to a sufficient height the contents of the ventricle will be discharged through the aortic valve into the aorta, and thus (through a convenient metal tube) into the arterial tube, leading to the capillary resistance. Here two paths may be taken: the liquid may pass either through the capillary channels in the cane, thus meeting with a high resistance, or this resistance may be lessened to any desired degree by unscrewing a clamp and thus opening the side tube. Both paths lead to the venous tubes, whence the liquid passes through the mitral valve into the ventricle. The mitral and aortic valves are of a modified Williams type. Metal tubes closed at one end conduct the liquid respectively to or from the ventricle. The liquid enters or leaves the valve tube through a hole covered by a rubber valve-flap, not shown in Fig. 1. Each valve is surrounded by a glass tube through which the working of the valve may be inspected.

Mercury manometers measure the pressure in the arteries and veins near the capillary resistance. The arterial manometer is provided with a glass thistle-tube to catch any mercury that may be driven out by a careless operator.

If the arterial mercury manometer be replaced by a membrane manometer, or if it be provided with a float and writing-point arterial pressure curves may be written, identical with those obtained from the carotid artery of the dog.

Normal sphygmographic tracings may be obtained by using a sphygmograph on the aortic tube.

Palpation of the arterial tube will give a pulse the 'feel' of which can not be distinguished from that of the pulse in the normal subject; the pressure waves in the quantitative scheme and in the living animal are identical in respect of both time and pressure.

W. T. PORTER.

HARVARD MEDICAL SCHOOL.

ROCKING KEY WITH METAL CONTACTS.

THE instrument illustrated by the figure serves as a simple key, short-circuiting key,

tion.' She devotes a dozen or so pages to a brief historical sketch and several pages to the methods of collecting, fixing, sectioning and staining which she followed, and then takes up in successive chapters, 'Microsporogenesis,' 'The Male Gametophyte,' 'Macrosporogenesis,' 'The Female Gametophyte,' 'Fertilization and Related Phenomena.' In a short appendix the author has recorded a number of interesting and suggestive abnormal conditions which have been noticed by her and other observers. A full list of papers cited closes the text of this altogether admirable paper. The plates number twenty-four and include 275 well executed figures.

The work upon which the paper was based was begun in the fall of 1897. The discoveries of Hirase, Ikeno and Webber in the fertilization of the gymnosperms made it 'highly desirable that fertilization and the associated phenomena should be worked out for other members of this group by the more modern methods of investigation.' This was the task which Miss Ferguson set for herself, and in this paper she has recorded the results of her investigation of five species of pines (*Pinus strobus, P. rigida, P. austriaca, P. montana uncinata* and *P. resinosa*). Six hundred separate collections of material were made, and more than four thousand slides of serial sections prepared. This large number is necessary since in the pines a period of almost thirteen months elapses from pollination to the actual fertilization, during which many important cytological changes take place.

We have space to note here only a few things brought out in this paper: The author makes a distinction between the microspore (one-celled) and the pollen-grain (several-celled), the former developing into the latter by a series of divisions. In tracing the development of the sperm-nuclei (spermatozoids) Miss Ferguson finds what she suggests may be the vestigial state of the cilia-forming body found in the lower gymnosperms (*Cycas, Zamia* and *Ginkgo*). In the development of the macrospore the division of the mother cell is a true tetrad division, so that the macrospore is a true spore. This germinates and by a typic division gives rise to two nuclei which pass to opposite poles and there divide again and again until thirty-two or more free nuclei are formed before the long winter rest is entered upon. The prothallium is completed and the archegones (one to nine) are formed the next spring. In fertilization the sperm and egg-cell cytoplasms fuse, but the nuclei do not really fuse, but the chromosomes are mingled in the first mitosis.

LIMU.

This is the name applied to many species of seaweeds, especially those that are edible, by the native Hawaiians. In a recent number of the 'Publications' of the University of California (Vol. III., No. 3) Professor Dr. Setchell gives the results of the investigations made by him several years ago, with a view to determining the specific identity of the different kinds of limu. Altogether his list includes one hundred and seven names, not, however, representing that many distinct kinds. For many of these he has been able to determine the species used, while in other cases this has not been possible. One is surprised at the considerable number of species of seaweeds which the islanders have found to be edible, although one suspects that many of them would not be relished by us.

A NEW GRASS BOOK.

Although not strictly botanical the little book entitled 'Farm Grasses of the United States,' by Professor Spillman (Orange Judd Co.), is worthy of a brief notice in these columns. In it the author, who as is well known, is the chief of the Division of Agrostology of the United States Department of Agriculture, has brought together a good many facts that are of interest to the farmers of the country, and some also that will interest the general botanist. Thus the map on page 13 showing the relative amounts of wild, salt and marsh grasses annually cut for hay in different parts of the United States will interest every botanist, and so will the chapter on 'The Seed' (V.). So too the botanist will find something of interest in the succeeding chapters (VI. to XIII.) which discuss timothy, the blue-grasses, the millets, two

southern grasses, red-top, orchard grass, brome grass, grasses of minor importance and those for special conditions. The book will be especially useful to farmers.

THE USEFUL PLANTS OF GUAM.

IN a thick pamphlet of about four hundred pages issued by the United States National Herbarium ('Contrib.,' Vol. IX.) William E. Safford tells what is known as to the vegetation of the island of Guam, nearly 145 degrees east of Greenwich, and a little less than 14 degrees north of the equator. It is illustrated by 70 plates mostly from photographs, including one map of the island. It will be very useful to American botanists who wish to know more about the vegetation of this newly acquired territory, as well as those who wish to learn something as to tropical vegetation in general. The chapters relating to the geography, climate, animals and the people are also full of interest for the general reader, as well as the student of science.

CHARLES E. BESSEY.

THE UNIVERSITY OF NEBRASKA.

SCIENTIFIC NOTES AND NEWS.

PROFESSOR CHARLES S. MINOT has been reelected president of the Boston Society of Natural History.

DR. E. F. NICHOLS, professor of physics at Columbia University, has been awarded the Ernest Kempton Adams research fellowship, recently established at Columbia University by Mr. E. D. Adams in memory of his son. Professor Nichols has at present leave of absence and is working at Cambridge University.

ABOUT five hundred physicians of the United States and Canada were present at the dinner given in honor of Dr. William Osler, which was held in New York on May 2. The toastmaster was Dr. James Tyson, of Philadelphia, and the list of speakers and of the toasts to which they responded was: Dr. Osler in Montreal, 'Student and Teacher,' Dr. F. J. Shepherd, of Montreal; Dr. Osler in Philadelphia, 'Teacher and Clinician,' Dr. J. C. Wilson, Philadelphia; Dr. Osler in Baltimore, 'Teacher and Consultant,' Dr. W. H. Welch, of Baltimore; Dr. Osler, 'The Author and Physician,' Dr. A. Jacobi, of New York City; presentation of 'Cicero de Senectute,' by Dr. S. Weir Mitchell, of Philadelphia. To these speeches Dr. Osler replied.

THE expedition to the Delta of the Colorado river and the Cucopa mountains organized by Dr. D. T. MacDougal, of the New York Botanical Garden, and Mr. E. A. Goldman, of the U. S. Biological Survey, has returned. The river was found in flood, the water reaching the highest level since 1891 and overflowing through various channels into the Salton Basin. Some important geographical details were brought to light and material additions were made to the knowledge of the natural history of the entire region, part of which had never before been visited by collectors.

THE Alexandre de la Roquette gold medal of the French Geographical Society has been awarded to Professor Erich von Drygalski.

THE Société de Topographie de France has awarded a medal to Dr. William Hunter Workman for topographical research among the high peaks and glaciers of the Himalayas.

PROFESSOR LÉON LABBÉ, the eminent French surgeon, has been presented by his former students with a medal struck in his honor by Patey.

THE Senckenberg Scientific Society of Frankfort has awarded its Sömmering prize for the most valuable work of a German investigator in physiology during the last four years to Professor Haberlandt, of Graz, for a work on 'The Sense Organs of Plants for the Perception of Mechanical Stimuli.'

AT the annual meeting of the Boston Society of Natural History, on May 3, the first Walker prize, of $75, was given to Dr. W. B. McCallum, department of botany, University of Chicago; the second, of $50, to Mr. M. L. Fuller, United States Geological Survey, Washington, D. C. Their respective papers were 'Physiological Analysis of the Phenomena of Regeneration of Plants' and 'Quaternary Correlations around New York and on the Long Island Shore.'

Professor Lancereau, of Paris, has been elected president of the International Society for Combating Tuberculosis.

Professor C. H. Wind, having been appointed to a professorship in the University of Utrecht, has resigned the directorship of the Dutch Meteorological Institute, and Dr. E. van Everdingen has been appointed provisional director.

Dr. Herman V. Hilprecht, professor of Assyriology at the University of Pennsylvania, sailed for Germany on May 2.

A testimonial banquet and special exercises will be held, May 18, by the alumni of the St. Louis College of Pharmacy in recognition of Professor James M. Good's having completed his thirtieth year as a member of the faculty of that institution. He was also dean of the faculty from 1878 to 1903 inclusive.

Dr. William H. Dalrymple, M.R.C.V.S. (Eng.), of the department of veterinary medicine in the Louisiana State University, has been elected to membership in the Royal Institute of Public Health, London.

Mr. William Henry Pulsifer, a manufacturing chemist, who was elected a fellow of the American Association for the Advancement of Science in 1879, has died at the age of seventy-four years.

We regret also to record the deaths of M. Henri de Saussure, the zoologist, at the age of seventy-six years; of Dr. Julius Nessler, the agricultural chemist of Karlsruhe, at the age of seventy-seven years, and of Dr. Paul Behrens, professor of technical chemistry in the Technical Institute at Danzig.

There will be a civil service examination on June 14 to fill vacancies in the position of scientific assistant in the Department of Agriculture, at salaries of from $840 to $1,200 a year, depending on qualifications and experience.

The thirty-second general meeting of the American Chemical Society will be held in the rooms of the Buffalo Society of Natural Sciences, Buffalo, N. Y., June 22–24, 1905. The preparation of the program for the meeting is in the hands of a committee consisting of Victor Lenher, for the section of inorganic chemistry; Marston T. Bogert, for the section of organic chemistry; W. R. Whitney, for the section of physical chemistry; John H. Long, for the section of sanitary, agricultural and biological chemistry, and Francis A. J. Fitzgerald, for the section of industrial chemistry. Mr. Fitzgerald will give an address on Friday evening, June 22, upon the subject of 'Electrochemical Industries at Niagara Falls.' Excursions to industrial establishments in Buffalo will be arranged for Friday afternoon and an excursion to Niagara Falls is arranged for Saturday. There will be the usual subscription dinner at the Hotel Iroquois on Friday evening.

The annual *soirée* of the Selborne Society was held on May 3. Lord Avebury was expected to preside, and a large number of archeological and natural history exhibits were planned.

The French government has granted a subvention of $20,000 in aid of the International Congress on Tuberculosis, which is to be held in Paris in October, 1905.

Articles of incorporation have been filed at Albany by the Bausch, Lomb, Saegmuller Company, the object of the new corporation as set forth in the papers being the manufacture of engineering, astronomical, physical and other instruments of precision. The manufacturing plant of the company will be at Rochester, N. Y., in the north end of the new addition to the Bausch & Lomb factory, and the Bausch & Lomb Optical Company, at Rochester, N. Y., will be the sales' agents of the new company. Mr. George N. Saegmuller will transfer his establishment from Washington to Rochester. He is well known for the important scientific instruments that have come from his shops, including the telescopes of the Chamberlain, Georgetown, Manila and other observatories, and other astronomical and optical instruments. It is said to be the intention to establish a scientific bureau for computation and research on the lines of the Carl Zeiss works of Jena, the re-

sults to be available both to the Bausch & Lomb Optical Company and the Bausch, Lomb, Saegmuller Company.

SENATOR WM. A. CLARK, of Montana, has contributed to the University of Montana Biological Station a sum sufficient to defray the expenses of an expedition among the unknown mountains of Montana. The expedition will be under the direction of Professor M. J. Elrod, and will visit the high mountain on whose summit is the United States Geological Survey monument. Several unexplored glaciers lie high up on the mountain. Later the party will visit other summits in the drainage of the South Fork of Flathead River. T. A. Bonser, of the Spokane High School, will look after the botany on the expedition. Later the party will return to Flathead Lake to take up the work of the University of Montana Biological Station. The expedition will start about June 20, and the return to Flathead Lake will be about the middle of July.

WILLIAM S. CHAMP has sailed for Liverpool to head a relief expedition on the ship *Terra Nova,* which is awaiting him in London. Mr. Champ's instructions from Mr. Ziegler are said to be to remain in the north until he has found Captain Fiala or his party. Mr. Champ is accompanied by Dr. Oliver L. Fassig, of Johns Hopkins University, a geographer, who will sail on an independent expedition on the *Belgica* to the east coast of Greenland, where, at Shannon Island, caches of food will be established for Captain Fiala, in the belief that he may return from the Arctic by that route. The expeditions will start about June 1.

THE New Zealand legislature passed in 1903 a law under which the metric system of weights and measures might be adopted at any time subsequent to January 1, 1906. The government has now announced its intention of adopting the system after an interval of twelve months.

AT the annual meeting of the Zoological Society of London, on April 28, the report was presented by the secretary, who stated that the number of fellows was greater than at any time in the history of the society. There was an increase of 48,866 in the number of visitors at the gardens, the total being 706,074, as against 657,208 in 1903. The cost of feeding the stock at the gardens was £3,423 4s. 5d., against £4,858 2s. in 1902. The total number of vertebrate animals in the menagerie was 2,552—640 mammals, 1,448 birds, 343 reptiles and amphibia and 121 fish.

ACCORDING to *Terrestrial Magnetism and Atmospheric Electricity* there will be a meeting of the International Committee on Terrestrial Magnetism and Atmospheric Electricity at Innsbruck during the meeting of the International Meteorological Congress. The opening meeting will be on September 9, the special meetings of the committee will probably be deferred, however, for a few days, in order to give ample time for those magneticians and electricians to attend who will participate in the eclipse observations of August 30. It is very much hoped that there will be a full attendance of investigators in terrestrial magnetism and atmospheric electricity.

THE same journal states that in the future the Kew magnetic observatory work is to be carried on at Eskdalemuir, Scotland. The site is in the valley of the Esk, towards the north of Dumfriesshire, one of the southern counties of Scotland. Being over fifteen miles from the nearest railway and in a rather inaccessible position, the probability of future disturbance is small. In addition to the magnetographs, the equipment, which is not yet fully decided upon, will consist of self-recording instruments for at least atmospheric electricity and earth tremors. In addition to the variometer building two absolute observation huts are being erected. The standardizations of magnetic instruments will be continued as heretofore, at the Kew Observatory, Richmond.

WE learn from *The Observatory* that Professor H. H. Turner, Savilian professor of astronomy at Oxford, gave a series of three afternoon lectures at the Royal Institution on March 2, 9 and 16. The series was entitled 'Recent Astronomical Progress,' and in the first the lecturer, dealing with solar matters,

explained recent developments of the sun and earth-magnetism question, and described the new observatory on Mount Wilson, California, and its proposed work. The second lecture was devoted to an explanation of the lunar theory. On March 16 he spent some time in giving an account of the work at some American observatories and in showing photographs of nebulæ.

UNIVERSITY AND EDUCATIONAL NEWS.

It was announced at the meeting of the trustees of Columbia University, on May 1, that $500,000 had been given by an anonymous donor for the construction of a new college hall. Ground has already been broken for the new building in accordance with plans prepared by Messrs. McKim, Mead and White, the architects of the university. It will stand at the southeast corner of Amsterdam Avenue and 116th St., adjoining the dormitories now in course of erection. The building will be known as Hamilton Hall, in honor of Alexander Hamilton of the class of 1777, and will thus perpetuate the name of the college building before the removal of Columbia University to its new site.

The legislature of Minnesota which has just adjourned, made direct appropriations for the University of Minnesota for the next two years amounting to $706,600, besides $58,000, derived from the insurance on the old main building, destroyed by fire last September. The largest items covered by the appropriation are $408,000 for a new main building, and $60,000 per year to the current expense fund. Besides money received by direct appropriation from the legislature, the university has a regular annual income of $438,000, derived from the tax levy, invested funds and other sources.

Ground has been broken for the new building for the College of Agriculture at Cornell University. It is expected that the buildings will be completed in the summer of 1906 at a cost of $250,000.

Professor Alpheus S. Packard bequeathed about 2,000 scientific books to Bowdoin College. He also bequeathed $200 to the college to be reinvested until it shall amount to $2,000, when it shall be called the Packard Scholarship, in memory of his father, Professor A. S. Packard, class of 1816. The interest is to be used for the aid of students in botany, zoology and geology.

A professorship of civil engineering in the University of Birmingham with a salary of £600 has been established. The professor will be allowed to take higher consultative work, to keep in touch with civil engineering practise, provided that it does not interfere with his university duties. Applications, accompanied by 75 copies of testimonials, should be received by the secretary not later than May 20.

At the University of Nebraska departments of pathology and bacteriology, of applied mechanics and machine design, and of geography have been created. Dr. R. H. Wolcott has been promoted to a professorship of anatomy; G. R. Chatburn to an associate professorship of applied mechanics and machine design; G. E. Condra to an associate professorship of geography and economic geology, and Herbert A. Waite to an associate professorship of pathology and bacteriology.

Dr. Ralph Garrigue Wright, B.S. (Columbia, 1899), Ph.D. (Basel, 1902), who has been acting as Professor Bogert's private assistant in connection with some investigations in organic chemistry at Columbia University this year, has been called to the professorship of chemistry at Washington and Jefferson College.

Mr. D. A. Lyon, instructor in geology and mining in Stanford University, has been promoted to an assistant professorship.

Messrs. O. A. Molatch and W. M. Kelsie have been appointed assistants in chemistry in Cornell University.

Mr. Charles F. McKim, of Messrs. McKim, Mead and White, and Mr. Thomas Hastings, of Messrs. Carrere and Hastings, have been appointed directors of ateliers, with the rank of professor in the School of Architecture of Columbia University.